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EAST
SOUTH
S.W.
WEST
N.W.

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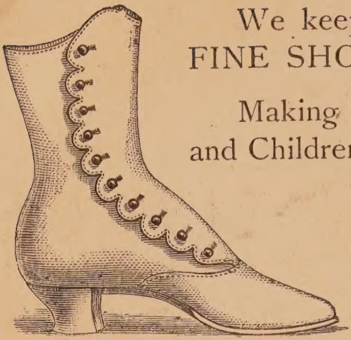

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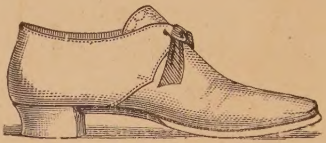

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A GUIDE

TO

PRACTICAL NAVIGATION.

CONTAINING

THE RULES AND METHODS OF SOLVING PROBLEMS IN THE MOST PRACTICAL MANNER; THE SIMPLEST AND MOST COMPLETE METHOD FOR FINDING A SHIP'S POSITION AT SEA, AS WELL AS A THOROUGHLY APPROVED METHOD OF FINDING THE LATITUDE AND LONGITUDE AT THE SAME INSTANT OF TIME. BY DOUBLE ALTITUDES.

BY

CAPTAIN E. McNEVIN.

SAN FRANCISCO:
A. L. BANCROFT & COMPANY, PRINTERS,
721 Market Street.
1878.

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PREFACE.

This treatise has been written, not for scientists but for seamen; to enable the navigator to find at any time quickly and accurately, his position at sea. By carefully studying the rules, and solving the problems herein given, he will assuredly be able to do so. The problems are solved in the simplest manner, and are only such as an experience of twenty years in the mercantile service has shown me to be necessary.

This book is therefore not encumbered with matter and tables seldom or never used, at least by those in command of merchant vessels; all extra methods of determining latitude and longitude, either difficult in themselves or of doubtful accuracy, (such as lunar and stellar observations) being wholly omitted. This book, it is hoped will enable a seaman of ordinary education to instruct himself in all that is really necessary for him to know, while at the same time it will aid rather than repel (as many works have done) those desirous of subsequently attaining in this fine science a higher degree of skill than is needed for ordinary navigation.

To polar-star observations for finding latitude, (of which some examples are given) I do not attach much importance, as the pole star is too dim for observation, demanding, (what is seldom to be had,) a well defined horizon, and is besides, available only in the Northern hemisphere. As to lunars, aside from the expense of the requisite tables, and the fact that they would not be understood by more than one out of twenty, they are rendered still less necessary since the perfecting of chronometers. In my long career I have met but few men who could take, accurately, distances by lunar observations; though every master, when questioned as to his ability in this respect, can do so to perfection. There are a number of lunar tables published, but to those wanting such I would recommend Thompson's as being both simple and accurate.

I have given Napier's logarithmic tables of natural numbers, being indispensable for accuracy in nautical calculations. These tables, Captain Thom, in his treatise, not only omits, but repudiates, telling us, forsooth, that they "are never used at sea!" He might almost as well have said that the compass had been rendered obsolete by some "method" of his for finding the north. I mention this that no one may be led astray by statements so absurd. Moreover, we should never rely (as does this author) upon the crude approximations of inspection. The necessary rules, however, for working by this method, are given for those who wish to employ them.

For finding latitude by stellar altitudes (which circumstances not infrequently render desirable at sea) I have referred to the American Ephemeris for the declination of the fixed stars instead of to the English tables; and have also followed the star-notation of the former. I have used a portion of the latter only in the problems for exercise in this work.

I would call the student's special attention to the system of finding simultaneously latitude and longitude by double altitude; a system not to be found in any American work that I have seen, and one upon which too much stress can scarcely be laid.

In this work I would also call attention to a leeway indicator, (of which a diagram is given) and which I have long used with great satisfaction at sea. This it is believed will be found highly useful to the mariner.

In conclusion I would say, that as I have had in the preparation of this work only the needs and interests of sea-faring men in view, I trust that it will fulfill its mission and be thought worthy of their patronage.

EDMUND McNEVIN.

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DEFINITIONS.

1. The Equator is a circle passing round the Earth, equally distant from the poles, dividing the globe into the northern and southern hemispheres.

2. The Poles are the extremities of the earth's axis.

3. A Meridian is a great circle passing through both poles, crossing the equator at right angles, and dividing the globe into two parts, called eastern and western hemispheres.

4. The Ecliptic is the apparent annual path of the sun in the heavens.

5. The Tropics are that portion of the earth between 23½° N. and 23½° S.

6. Latitude is the number of degrees N. or S. of the equator.

7. Parallels of Latitude are circles parallel to the equator.

8. Longitude is the number of degrees E. or W. of Greenwich.

9. The Visible Horizon is the circle that bounds the observer's view at sea.

10. The Sensible Horizon is the circle that passes through the eye of an observer whose poles are in the zenith and Nadir.

11. The Rational Horizon is the circle parallel to the sensible horizon, whose plane passes through the center of the earth.

12. The True Course of a ship is the compass course corrected for deviation, lee-way and variation.

13. A Magnetic Course is a compass course corrected for lee-way and deviation.

14. A Compass Course is the course steered by a compass.

15. Variation of the compass is the angle between the true north and the magnetic north.

16. Deviation of the compass is the angle between the magnetic north and the compass north..

17. The Error of the compass is the sum of the deviation and variation.

18. Lee-way is the angle between the ship's course by compass and her path through the water.

19. The Meridian Altitude of a celestial object is the highest altitude it attains, or its altitude when on the observer's meridian.

20. Azimuth is the angular distance of a body from the meridian, measured on the horizon.

21. Amplitude is the complement of azimuth, or the true bearing of an object, east or west, on the horizon.

22. Declination is the number of degrees any celestial object is north or south of the equator; similar to latitude.

23. Polar Distance is the number of degrees an object is from the elevated pole.

24. Right Ascension is the distance of a celestial object from the first point of Aries, measured in time eastward on the equinoctial.

25. The Dip or Depression of the horizon is the angle contained between the sensible and the visible horizon.

26. Refraction is the difference between the real and the apparent place of a heavenly body, produced by the passage of the rays of light through the atmosphere.

27. Parallax is the difference between an altitude of a celestial body observed at the center of the earth and on the surface of the earth. Semi-diameter is half the angle under which the heavenly bodies appear to an observer on the earth.

28. An Observed Altitude is the height of the sun, moon, planet or star above the horizon, as measured by a quadrant or sextant.

29. The Apparent Altitude is the observed altitude corrected for index error and dip.

30. The True Altitude is the apparent altitude corrected for refraction and parallax.

31. Zenith Distance is the distance of a heavenly body from the zenith, or point of the heavens over our heads.

32. Vertical Circles are great circles passing through the zenith and Nadir; perpendicular to the horizon.

33. The Prime Vertical is a great circle passing through the zenith and Nadir, cutting the horizon in the east and west points.

34. Civil Time begins and ends at midnight; the first 12 hours called A. M.; the last 12 hours called P. M.

35. Astronomical Time is the time between two successive transits of the sun's mean center over the same meridian, which always begins at noon, and is reckoned through the 24 hours to noon again.

36. Mean Time is the hour angle of the mean sun westward of the meridian.

37. Apparent Time is the interval between the sun's departure from and his return to the same meridian; or time shown by the sun according to his altitude, reckoned westward of the meridian.

38. Equation of Time is the difference between mean time and apparent time.

39. The Hour Angle of a celestial object is an arc of the equator contained between the meridian of the place and that of the object.

40. The Complement of an arc or angle is what that arc or angle is short of being 90°.

41. The Supplement of an arc or angle is what that arc or angle requires to make it 180°.

42. The Co-latitude is the difference between a given latitude and 90°. Polar distance is a celestial object's distance from the north pole.

43. The difference of latitude of two places is the portion of the meridian included between their parallels.

44. The difference of latitude of a ship is the distance she makes from any point, north or south.

45. The difference of longitude of two places is the portion of the equator included between their meridians.

RIGHT-ANGLED TRIANGLE.

46. The course steered is the angle between the meridian and the ship's head; the course made good is the angle between the meridian and the ship's real track on the ocean.

47. The course is reckoned from the meridian accordingly, north or south towards the east or west, if less than eight points, or 90°.

48. The course is measured in points of 11° 15′ each.

49. The rhumb line is the ship's track when crossing all the meridians at the same angle.

50. The distance between two places, or the distance sailed by the ship on a certain course, is measured in nautical miles of 60 to the degree of latitude, each containing 6082 feet.

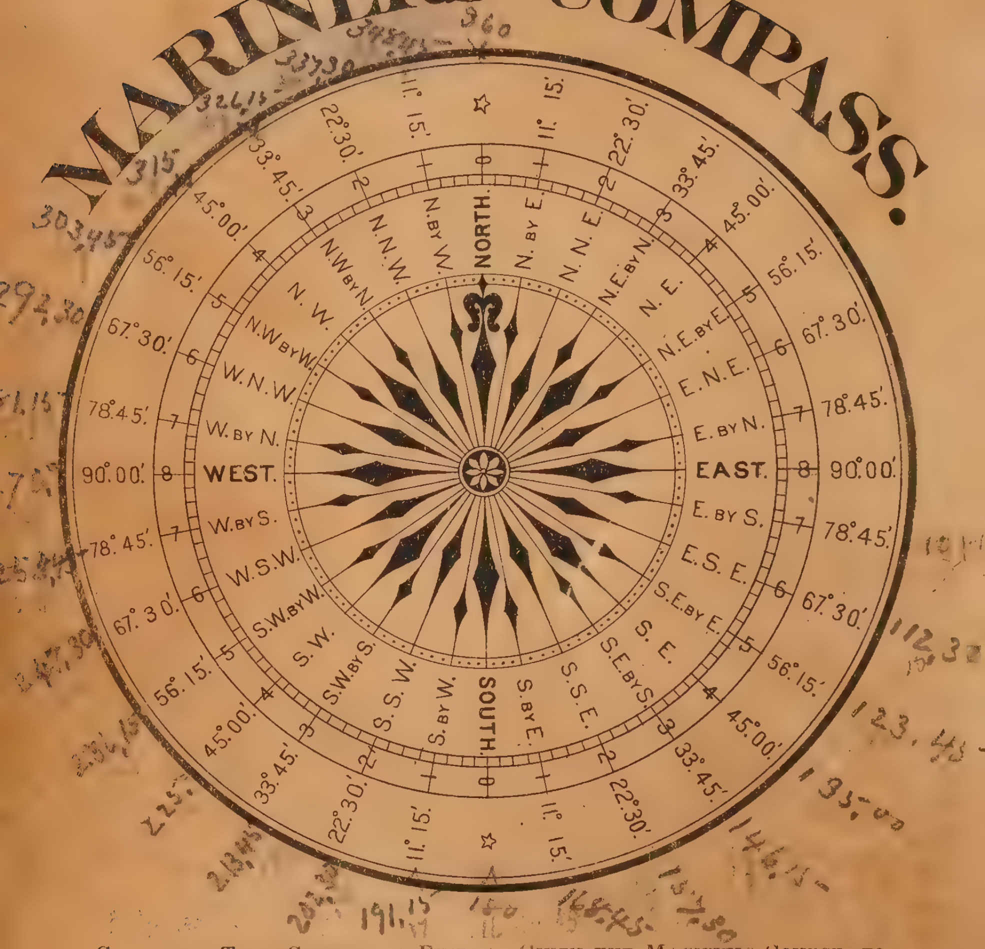
51. Three such miles make a league.

52. The departure is the distance sailed due east or west, or the distance from the ship's first meridian, and is always equal to the difference of latitude in miles. It is also called easting or westing, and is always expressed in miles. When a ship sails due east or west she makes no difference of latitude.

53. The difference of latitude is the space contained between two parallels of latitude, and is counted on the meridian. When a ship sails north or south she makes no departure.

54. Taking a departure means taking the bearing of any object by compass, or its angle with the meridian, and estimating its distance from the ship on leaving the land.

MARINERS' COMPASS.



GIVEN THE TRUE COURSE, TO FIND THE MAGNETIC COURSE.

Easterly variation allow to the left hand.

Easterly deviation allow in the same way.

Westerly variation allow to the right hand.

Westerly deviation allow in the same way.

GIVEN THE MAGNETIC COURSE, TO FIND THE TRUE COURSE.

Easterly variation allow to the right hand.

Easterly deviation allow in the same way.

Westerly variation allow to the left hand.

Westerly deviation allow in the same way.

ALLOW LEEWAY FROM THE WIND.

A TABLE OF THE ANGLES

Which every point and quarter point of the compass makes with the meridian.

NORTH.		POINTS.	°	′	″	POINTS.	SOUTH.	
			D.	M.	S.			
		0¼	2	48	45	0¼		
		0½	5	37	30	0½		
		0¾	8	26	15	0¾		
N b E	N b W	1	11	15	00	1	S b E	S b W
		1¼	14	03	45	1¼		
		1½	16	52	30	1½		
		1¾	19	41	15	1¾		
N N E	N N W	2	22	30	00	2	S S E	S S W
		2¼	25	18	45	2¼		
		2½	28	07	30	2½		
		2¾	30	56	15	2¾		
N E b N	N W b N	3	33	45	00	3	S E b S	S W b S
		3¼	36	33	45	3¼		
		3½	39	22	30	3½		
		3¾	42	11	15	3¾		
N E	N W	4	45	00	00	4	S E	S W
		4¼	47	48	45	4¼		
		4½	50	37	30	4½		
		4¾	53	26	15	4¾		
N E b E	N W b W	5	56	15	00	5	S E b E	S W b W
		5¼	59	03	45	5¼		
		5½	61	52	30	5½		
		5¾	64	41	15	5¾		
E N E	W N W	6	67	30	00	6	E S E	W S W
		6¼	70	18	45	6¼		
		6½	73	07	30	6½		
		6¾	75	56	15	6¾		
E b N	W b N	7	78	45	00	7	E b S	W b S
		7¼	81	33	45	7¼		
		7½	84	22	30	7½		
		7¾	87	11	15	7¾		
EAST	WEST	8	90	00	00	8	EAST	WEST

PRACTICAL NAVIGATION.

MULTIPLICATION BY LOGARITHMS.

Place the numbers one under the other, the same manner as if they were to be multiplied by common multiplication.

Give to each number its own index, which *will always be one less* than the figures in the whole number.

Next, in Table I (logarithms of numbers), find the log. corresponding to each number, and place as in the worked example opposite; then *add* the *logarithms* and *indexes together*, and the index now obtained will show how many figures are wanted in the answer, which is always *one more* than the *index.*

Rule for getting Five, or more Figures in the Answer.

Find the Logarithm next less to the given log. which will point out the first four figures of your answer—three on the left side, and the other at the head of the column you find the next less in; then take the next less log. found from yours, to which annex as many ciphers as there are figures wanted more than four, divide this by the difference, which is found in the column on the right hand side, and the quotient will be the remaining figures required; and if you want to turn the remainder into a decimal, annex a cipher and divide again by the same difference as before.

Rule for taking out a Logarithm for a number consisting of Five, or more figures.

Take out a log. for the first four figures and set it out to one side; then multiply the figures that there are more than four in your number, by the difference on the right hand side of Table I. Cut off from the product to the right hand *as many as you had over four in your number*, and what remains being added to the logarithm taken out for the first four figures, makes the logarithm required for the whole number.

When the first of the figures pointed off is five, or exceeds five, add one to the figures you are going to apply to the log. of the first four figures.

Multiply 7235 by 822, by Common Logarithms.

7235 = 3.859438 } Add in Multiplication.
822 = 2.914872 }

Ans. 5947164 = 6.774310
774298 nearest less log.

Diff. 73) 12000 (164
73
470
438
320
292
28 Remainder.

Multiply 7890 by 987, by Common Logarithms. Ans. 7787428
Multiply 4789 by 976, by Common Logarithms. Ans. 4674064
Multiply 5648 by 765, by Common Logarithms. Ans. 4320720
Multiply 6979 by 878, by Common Logarithms. Ans. 6127549
Multiply 7898 by 549, by Common Logarithms. Ans. 4336000
Multiply 348.25 by 71.25, by Common Logarithms. Ans. 24812.8*
Multiply 7298 by 3.475, by Common Logarithms. Ans. 25360.58*
Multiply 3650.0 by 208.0, by Common Logarithms. Ans. 759200
Multiply 65703 by 475, by Common Logarithms. Ans. 31208920

NOTE.—A decimal is got by annexing a cipher and dividing again. Read explanation of Table I carefully.

DIVISION BY LOGARITHMS.

Place the number and their indexes as in multiplication, and get out the Logarithms, which are *subtracted* in division.

When dividing for the figures wanted more than four, remember you do not use more than one cipher at a time, viz: Suppose the difference between the logs is 15, and you annex three ciphers which make 15,000; now, if this is to be divided by say, 160)15,000(0 is the first figure because it will not go in 150, that is, taking one of the ciphers only at a time; and should it not go with another cipher taken in, as it may sometimes occur, then the second figures will also be 0. And again, should the logs, when looking for the next less, agree exactly, then, where they agree, it gives you the first four, and any more wanted will be ciphers annexed to make the required number; for example—the index is 8 and the first four got out is 7799, then the proper answer is 779900000.

Divide—8756403 by 228 by Common Logarithms.

Log. of 1st 4 figures.

8756403 = 6.942326——942306——403 left over four.
228 = 2.357935 20 50 diff.

Ans. 38405.3 = 4.584391 942326 20.150
584331

113) 600 (5.3
565

113) 350 (3
339

11 Remainder.

Divide	5678465 by	425, by Common Logarithms.	Ans.	13361.
Divide	8789786 by	540, by Common Logarithms.	Ans.	16277.
Divide	4785895 by	487, by Common Logarithms.	Ans.	9827.
Divide	34650 by	185, by Common Logarithms.	Ans.	187.297.
Divide	3876000 by	.12, by Common Logarithms.	Ans.	32300074.
Divide	8247877 by	789, by Common Logarithms.	Ans.	10453.
Divide	248.603 by	3910, by Common Logarithms.	Ans.	.06358.
Divide	8.50078 by	890.1, by Common Logarithms.	Ans.	.009550.
Divide	84361912 by	.0341, by Common Logarithms.	Ans.	2473960227.

REDUCTION.

To reduce Degrees, Minutes and Seconds of Arc, to Minutes or Seconds of Arc.

Multiply the degrees by 60, and to the product add the minutes. This sum is the whole of the minutes.

Again multiply this sum by 60, and to the product add the seconds.

This last sum is the whole of the seconds.

Ex. 1. Reduce to minutes.
12° 27′
× 60
Ans. 747 miles.

Ex. 2. Reduce to seconds.
35° 00′ 26″
× 60
2100
× 60
Ans. 126026″

To reduce Seconds or Minutes of Arc, to Degrees, Minutes and Seconds.

Divide the seconds by 60, and the remainder, if there be any, will be the odd seconds.

Again divide the preceding quotient by 60, and the remainder will be the odd minutes.

And the last quotient will be the degrees, minutes and seconds.

Ex. 1. Reduce 946 minutes to degrees and minutes.

60)946′

15° 46′

Ex. 2. Reduce 5674 seconds to degrees, minutes and seconds.

60)5674″

60)94′ 34″

Ans. 1° 34′ 34″

COMPOUND ADDITION.

To add Degrees, Minutes and Seconds of Arc.

Place degrees under degrees, minutes under minutes, and seconds under seconds.

Add the seconds together, and if their sum be 60 or upwards, reduce it to minutes and seconds.

Place the seconds that remain under the other seconds, and add the minutes to the other minutes. If the sum of the minutes equal 60, or more, reduce it to degrees and minutes:

Place the minutes that remain under the other minutes, and add the degrees to the other degrees.

Ex. 1. Add 49° 38′ and 22° 58′ together.

49° 38′
22 58

Ans. 72° 36′

Ex. 2. Add 105° 32′ 18″ and 158° 02′ 10″.

105° 32′ 18″
158 02 10

Ans. 263° 34′ 28″

COMPOUND SUBTRACTION.

To take the Difference between Degrees, Minutes and Seconds of Arc.

Place the quantities as in addition.

Begin at the seconds of the lesser quantity, and subtract them from those of the greater.

If the seconds of the lesser quantity be more than those of the greater, add 60 to those of the greater, and subtract those of the lesser from the sum.

In the same manner subtract the minutes of the lesser quantity from those of the greater.

If 60 has been added to the minutes of the lesser quantity before subtracting them, proceed in the following manner with the degrees:

Ex. 1. Subtract 4° 15′ 40″ from 8° 22′ 26″.

8° 22′ 26″
4 15 40

Ans. 4° 06′ 46″

Ex. 2. Subtract 30° 28′ 54″ from 80° 40′ 20″.

80° 40′ 20″
30 28 54

Ans. 50° 11′ 26″

LATITUDES.

To find the Difference of Latitude between Two Places whose Latitude is given.

When both latitudes are of the same name, that is, when they are both north or both south, take their difference by subtracting one from the other, for the difference of latitude.

When the latitudes are of different names, that is, when one is north and the other south, take their sum by adding both latitudes together for the difference of latitude.

To name the different latitudes, consider whether the place bound to is north or south of the ship's place, and mark the different latitude north or south accordingly.

Ex. 1. Given Point Bonita in latitude 37° 49′ N. and Cape Mendocino in latitude 40° 26′ N. Required the difference of latitude.

Latitude Point Bonita	37°	49′	N.
Latitude Cape Mendocino.	40	26	N.
Difference of latitude =	2°	37′	
	× 60		
	157 miles.		

Ex. 2. Given Point Bonita in latitude 37° 49′ N. and Callao in latitude 12° 04′ S. Required the difference of latitude.

Latitude Point Bonita....	37°	49′	N.
Latitude Callao.........	12	04	S.
Difference of latitude =	49	53′	S.
	× 60		
	2993 miles.		

Given the Latitude Left and Difference of Latitude, to find the Latitude In.

When the latitude left and the difference of latitude are of the same name, add them together, their sum is the latitude in, and of the same name as the latitude left.

When the latitude left and difference of latitude are of different names, subtract the lesser from the greater, and their difference is the latitude in, of the same name as the greater.

Ex. 1. Given the latitude left 19° 06′ N, and difference of latitude 2° 24′ N. Required the latitude in.

Latitude left...	19°	06′	N.
Difference lat..	2	24	N.
Latitude in	21°	30′	N.

Ex. 2. Given the latitude left 8° 04′ N. and difference of latitude 6° 05′ S. Required the latitude in.

Latitude left...	8°	04′	N.
Difference lat...	6	05	S.
Latitude in	1°	59′	N.

Having the Latitude In, and Latitude Left, to find the Middle Latitude.

Add the latitudes together and divide the sum by 2, and the result is the middle latitude.

When the latitudes are of different names, add the half of the greater latitude to the half of the less latitude, and take their half sum for the middle latitude.

If one latitude be great and the other small, take the half of the greater latitude for the middle latitude.

Ex. 1. Given latitude left 19° 05′ N. and latitude in 6° 04′ N. Required the middle latitude.

Latitude left.. 19° 05′ N.
Latitude in... 6 04 N.
2)25 09
Ans. 12° 34′ mid. lat.

Ex. 2. Given latitude left 32° 19′ S. and latitude in 57° 24′ S. Required the middle latitude.

Latitude left... 32° 19′ S.
Latitude in.... 57 24 S.
2)89 43
Ans. 44° 51′ mid. lat.

Ex. 3. Latitude of A. 40° 43′ N.—Half of A. 20° 21′
Latitude of B. 34° 22′ S.—Half of B. 17° 11′
2)37° 32′
Middle latitude, 18° 46′

To take out of the tables the Meridional Parts for a Given Latitude.

Look for the number of degrees of latitude at the top of the table, and for the number of the minutes of latitude in the column marked miles. Then look down the column of figures under the degrees, until it meets the line of figures opposite the minutes.

Take out the number at the point of meeting, which will be the meridional parts for the given latitude.

Ex. 1. Find the meridional parts of 36° 58′.................Ans. 2390.
Ex. 2. Find the meridional parts of 28° 10′.................Ans. 1762.
Ex. 3. Find the meridional parts of 46° 48′.................Ans. 3185.
Ex. 4. Find the meridional parts of 38° 59′.................Ans. 2544.

Given the Latitude Left and Latitude In, to find the Meridional Difference of Latitude.

Take out the meridional parts for both latitudes.

When both latitudes are of the same name, take the difference of the meridional parts for the meridional difference of latitude.

When the latitudes are of different names, take the sum of the meridional parts for the meridional difference of latitude.

Ex. 1. Given latitude left 39° 44′ N. and latitude in 46° 24′ N. Required the meridional difference of latitude.

Lat. left 39° 44′ N. mer. parts 2602.
Lat. in 46 24 N. mer. parts 3150.
6 40 Mer. diff. lat. 548 mls.
×60
400 miles.

Ex. 2. Given latitude left 4° 28′ N. and latitude in 2° 58′ S. Required the meridional difference of latitude.

Lat. left 4° 28′ N. mer. parts 268.
Lat. in 2 58 S. mer. parts 178.
7 26 Mer. diff. lat. 446 mls.
×60
446 miles.

Given the latitude left in, as follows; required the meridional difference of latitude:

No.	Lat. left	Lat. in	Ans.	No.	Lat. left	Lat. in	Ans.
1	28° 40′ N	30° 31′ N	127	4	2° 48′ S	2° 52′ N	340
2	19° 46′ S	26° 30′ S	440	5	4° 28′ N	2° 58′ S	446
3	22° 50′ N	26° 22′ S	3049	6	65° 27′ S	1° 08′ S	5175

Given the Longitude of Two Places, to find their Difference of Longitude.

When both longitudes are of the same name, that is, both east or west, take their difference for the difference of longitude.

When the longitudes are of different names, that is, one east and the other west, take their sum for the difference of longitude.

When the difference of longitude exceeds 180° take it from 360° and the remainder will be the difference of longitude.

Ex. 1. Given Nemen's Island in longitude 179° 07′ E. and Drummond's Island in longitude 174° 53′ E. Required their difference in longitude.

Longitude Nemen's Is.	179° 07′ E.
Longitude Drum. Is...	174 53 E.
Difference longitude...	4° 14′ E.
	× 60
	254 miles.

Ex. 2. Given Vomo Island in longitude 177° 14′ E. and the Eddystone in longitude 4° 16′ W. Required their difference in longitude.

Longitude Vomo Is...	177° 14′ E.
Longitude Eddystone.	4 16 W.
	181 30
	360 00
Difference longitude.	178° 30′
	× 60
	10710 miles.

Given the longitudes of two places, A and B, as follows; required their difference in longitude.

No.	Longitude.		Ans.	No.	Longitude.		Ans.
	A	B			A	B	
1	128° 32′ W	138° 23′ E	93° 05′	4	113° 42′ E	99° 26′ W	146° 52′
2	66° 24′ E	78° 37′ W	145° 01′	5	3° 10′ E	4° 05′ E	0° 55′
3	46° 28′ W	52° 46′ E	99° 14′	6	0° 16′ W	0° 32′ E	0° 48′

Given the Longitude Left and Difference of Longitude, to find the Longitude In.

When the longitude left and difference of longitude are of the same name, take their sum for the longitude in, and it is of the same name as the longitude left.

When the sum exceeds 180°, take it from 360°, and the remainder will be the longitude in, of contrary name to the longitude left.

When the longitude left and difference of longitude are of contrary names, take their difference, which will be the longitude in, and of the same name as the greater.

Ex. 1. Given longitude left 44° 16′ W., and difference of longitude 1° 20′ W. Required the longitude in.

Longitude left.........	44° 16′ W.
Difference of longitude	1 20 W.
Longitude in..........	45° 36′ W.

Ex. 2. Given longitude left 165° 18′ W., and difference of longitude 7° 46′ W. Required the longitude in.

Longitude left........	175° 18′ W.
Difference longitude.	7 46 W.
	183 04 W.
	360 00
Longitude in........	176° 56′ E.

Given longitude left and difference of longitude, as follows; required the longitude in.

No.	Long. left	Diff. long	Ans.	No.	Long. left	Diff. long	Ans.
1	3° 40′ W	2° 10′ E	1° 30′ W	4	182° 00′ E	53° 20′ E	124° 40′ W
2	12° 42′ E	6° 20′ W	6° 22′ E	5	14° 22′ E	5° 00′ E	19° 22′ E
3	59° 16′ W	3° 53′ E	55° 23′ W	6	10° 20′ W	0° 35′ W	10° 55′ W

Given the Course and Distance to take out of Table III, for the Difference of Latitude and Departure.

If the course does not exceed 4 points or 45°, look for it at the head or top of the page; but if it exceed 4 points or 45°, look for it at the bottom of the page.

Find the distance in one of the columns marked "Dist.," and take out of the two adjoining columns, to the right hand, the numbers in the same line with it.

Observe whether the course is found at the top or bottom of the page, and mark the numbers taken out according as they are marked at the part of the page the course is found in.

Given course 2¾ points, distance 28 miles; to find difference of latitude and departure. (Table III.) Ans. Difference latitude 24.0; departure 14.4.

Given course 34°, distance 253 miles; to find difference latitude and departure. Ans. Difference latitude 209.7; departure 141.5.

Given the Difference of Latitude and Departure, to find the Course and Distance in Table IV.

Look in Table IV, until the difference latitude and departure, or numbers near to them are found together; take out the course and distance corresponding thereto.

Given difference latitude 55.4, departure 35.9; to find the course and distance. Ans. Course 33°; distance 66 miles.

Given difference latitude 71.0, departure 123.0; to find the course and distance. Ans. Course 60°; distance 142 miles.

TRAVERSE SAILING.

Traverse sailing is the finding of a single course or distance, such that it would have brought a ship to the same place that several courses and distances have done.

Form a table similar to the one annexed to the first example. The first column contains the several courses, the second contains the distance run on each course, the third and fourth are headed N. (for north) and S. (for south), and the fifth and sixth are headed E. (for east) and W. (for west). Find by inspection, the difference of latitude and departure for every course and distance. Proceed in the following manner: If the course does not exceed 4 points, or 45°, look for it at the top of the page; but if it exceeds 4 points, or 45°, look for it at the bottom of the page. (Table III.)

Find the distance in one of the columns (of Table III) marked "Dist.," and take out of the adjoining columns, to the right hand, the numbers in the same line with it.

Observe whether the course is found at the top or bottom of the page, and mark the numbers taken out according as they are marked at the part of the page the course is found in.

Set the difference of latitude under N. or S., according as the course is towards the north or south, and the departure under E. or W., according as the course is towards the east or west.

Then add the sums up carefully of the columns N., S., E. and W. Take the difference between the sums of N. and S., which will be the difference of latitude made good, of the same name as the greater. Then as before, take the difference between the sums of E. and W., which will be the departure made good, and to be named the same as the greater.

With the difference of latitude and departure made good, find the course and distance.

Look in Table IV, until the difference latitude and departure, or numbers near to them, are found together; take out the course and distance corresponding thereto.

1. A ship sails E. S. E. 14 miles, and then W. N. W. 28 miles; required the course and distance made good.

Course.	Dist.	Diff. N.	Lat. S.	Dep. E.	W.
S 6 E	14	"	5.4	12.9	"
N 6 W	28	10.7	"	"	25.9
	"	5.4	"	"	12.9
	"	5.3	"	"	13.0

Difference latitude 5.3, departure 13.0, give Table in IV. Course 68°. Distance 14′.

2. A ship sails N. W. 30 miles, N. N. E. 21 miles, and S. E. 17 miles; required the course and distance made good.

Course.	Dist.	Diff. Lat.		Dep.	
		N.	S.	E.	W.
N 4 W	30	21.2			21.2
N 2 E	21	19.4		8.0	
S 4 E	17		12.0	12.0	
		40.6	12.0	20.0	21.2
		12.0			20.0
		28.6	"	"	1.2

Difference latitude 28.6 N., departure 1.2 W., gives the course N. 2° W. Distance 29 miles.

PARALLEL SAILING.

To log. secant of the latitude *add* the log. of the departure, their sum less 10 from the index is the log. of the difference of longitude.

1. In latitude 66° 40′ north. The departure made good was 387 miles. Required the difference of longitude by Parallel Sailing.

Secant......Latitude	66° 40′	=	10.402217	Table II.
Log.........Departure	387	=	2.587711	Table I.
Difference of longitude	977.1		2.989928	Table I.

2. In latitude 36° 17′ south. The departure made good was 187 miles. Required the difference of longitude by parallel sailing. Ans. 232.0 miles.

3. In latitude 63° 39′ N. The departure made good was 8.25 miles. Required the difference of longitude by parallel sailing. Ans. 18′.59.

4. In latitude 53° 52′. The departure made good was 6.75 miles. Required the difference of longitude by parallel sailing. Ans. 11′.44.

5. In latitude 54° 12′ N. The departure made good was 596 miles. Required the difference of longitude by parallel sailing. Ans. 1019′.

6. In latitude 69° 11′ S. The departure made good was 64.75 miles. Required the difference of longitude by parallel sailing. Ans. 182′.2.

7. In latitude 43° 35′ S. The departure made good was 99 miles. Required the difference of longitude by parallel sailing. Ans. 136′.7.

8. In latitude 66° 40′ S. The departure made good was 387 miles. Required the difference of longitude by parallel sailing. Ans. 977′.1.

MIDDLE LATITUDE.

SAILING.

Middle latitude is half the sum of the two latitudes when they are of the same name, or half their difference if of contrary names.

Find the difference of latitude by subtracting if they are both north or both south, or adding, if one north and the other south.

Then reduce this difference of degrees to miles by multiplying the degrees by sixty (60) and call it proper difference of latitude.

Find the difference of longitude thus:—if both east or both west, subtract them; if one is east and the other west, add them, and if their sum exceeds 180° subtract the sum from 360°, and the remainder will be the difference of longitude.

Reduce this difference of degrees to miles in the same way as the latitude and call it difference of longitude.

The course must be named the same as the longitude left, when the sum of the longitudes has to be taken from 360°.

In working, proceed as per example.

NOTE.—The tables for working out all problems by Middle Latitude, sailing, are Tables I and II.

TO FIND THE DEPARTURE.

Find the logarithm of the difference of longitude, Table I of this book, call the index one less than the number of figures in the difference of longitude; find the first three figures in the left hand column, and opposite to them, and under the fourth figure at head of the column will be the required log., to which prefix the index, and this will give the log. required; and to find the log. co-sine of middle latitude, enter Table II, and with the degrees at the top or bottom of the page, and miles in the column of miles, will be found the log. wanted, the sum of these logs. Subtracting the radius will give the log. of the departure.

The index of radius is always 10.

TO FIND THE COURSE.

Find the log. of the difference of latitude by the same rule as the above, also the log. of the departure; add the log. of departure to the radius, and subtract the log. of the difference of latitude, and this will give the log.-tangent of the course. To find the tangent look in the column marked tangent at the top or bottom of the page, run up this column until the log. nearest to the given one is found, which will be the tangent of the course in degrees, the miles will be found in column of miles.

Having found the course, name it north or south, and east or west, according as you have to make northing or southing, easting or westing, to arrive at the place bound to.

TO FIND THE DISTANCE.

Add the log. of the difference of latitude to the log.-secant of the course, and subtract the radius, the difference will give the log. of the distance in Table I, if the index be 3, the answer will require 4 figures. Look in the column of logs. and find the nearest log., having done so, you will find the first three figures in the left hand column, and the fourth figure at the top over the column where the log. is found.

CASE 1.

Ex. 1. Required the course and distance from A. to B. by calculation of middle latitude, sailing principle.

The latitude of A. is 51° 01′ N., and longitude is 122° 27′ W.; the latitude of B. is 4° 22′ S., and longitude is 144° W.

A. lat. . 51° 01′ N.	51° 01′	Long. . 122° 27′ W.
B. lat. . 4 22 S.	4 22	Long. . 144 30 W.
Dif. lat. . 55° 23	2)46 39	22 03
60	23° 19′ Mid. lat.	60
Dif. lat. miles. 3323		1323 Dif. lon. mls.

TO FIND THE DEPARTURE.		TO FIND THE COURSE.		TO FIND THE DISTANCE.	
Radius	10.000000	Dif. lat. 3323	3.521530	Radius	10.000000
Dif. long. 1323	3.121560	Radius	10.000000	Dif. lat. 3323	3.521530
Mid. lat. 23° 19′ Cos.	9.962999	Departure 1215	3.084559	Course 20° 05′ . . Sec.	10.027245
	13.084559		3.084559		13.548775
	10.000000		3.521530		10.000000
Dep. 1215	3.084559	C'rses S. 20° 05 W′., tan.	9.563029	Distance 3538	3.548775

Ex. 2. Required the course and distance from A. to B. by calculation on middle latitude, sailing principle.

The latitude of A. is 31° 01′ S. and its longitude 162° 10′ W.; the latitude of B. is 38° 55′ S. and its longitude 152° 00′ E.

Lat. of A. . 31° 01′ S.	31° 01′	Long. . 162° 10′ W.
Lat. of B. . 38 55 S.	38 55	Long. . 152 00 E.
Dif. lat. 7 54	2)69 56	314 10
60	34° 58′ Mid. lat.	360
Dif. lat. miles . . . 474		45 50 Dif. lon.
		60
		2750 Dif. lon. mls.

TO FIND THE DEPARTURE.		TO FIND THE COURSE.		TO FIND THE DISTANCE.	
Radius	10.000000	Dif. lat. 474	2.675778	Radius	10.000000
Dif. long. 2750	3.439333	Radius	10.000000	Dif. lat. 474	2.675778
Mid. lat. 34° 58′ Cos.	9.913541	Dep. 2254	3.352874	Course 78° 07′ . . . . Sec.	10.686302
	13.352874		13.352874		13.362080
	10 000000		2.675778		10.000000
Dep. 2254	3.352874	C'rse S. 78° 07′ W. tan.	10 677096	Distance 2302	3.362080

Ex. 3. Required the course and distance from a place in the latitude of 36° 55′ S. and longitude of 20° 0′ E., to another place in the latitude of 32° 38′ S. and longitude of 8° 54′ W.

Ans. N. 79° 46′ W.; distance, 1447 miles; departure, 1424′.

Ex. 4. Required the course and distance from a place in the latitude of 37° 55′ N. and longitude of 54° 23′ W., to another place in the latitude of 32° 38′ N. and longitude of 17° 05′ W.

Ans. Course S. 80° 09′ E.; distance, 1854 miles; departure, 1827′.

Case II.

The Latitude, Course, and Distance being given, to find the Departure, Latitude and Longitude.

Ex. 1. A ship from latitude 29° 47′ N. and longitude 24° 36′ W., sails S. S. W. ¾ W. 960 miles. Required the departure, difference of latitude and longitude. (From compass card, S. S. W. ¾ W. is 30° 56′.)

TO FIND THE DIFFERENCE OF LATITUDE.		TO FIND THE LATITUDE IN.			
As radius.......................	10.000000	Dif. of lat. 823′..	13° 43′ S.	Lat. left...	29° 47′ N.
Is to distance 960..............	2.982271	Latitude left....	29 47 N.	Lat. in....	16 04 N.
So is co-sine of course 30° 56′	9 933369	Latitude in......	16 04 N.	Sum of lat 2)45 51	
	12.915640			Mid. lat....	22° 55′
	10.000000				
Is to dif. of lat. 60)823	2.915640				
13° 43′					

TO FIND THE DEPARTURE.		TO FIND THE DIFFERENCE OF LONGITUDE			
As radius..................	10.000000	As co-sine of mid. lat. 22° 55′	9.964294	Lon. left	24° 36′ W
Is to distance 960	2.982271	Is to the departure 493.......	2.693268	Dif. long.	8 56 W
So is sine of course 30° 56′	9.710997	So is radius..................	10.000000	Long. in	33° 32′ W
	12 693268		12.693268		
	10.000000		9.964294		
To the departure 493′....	2.693268	To dif. of long. 60)536	2.728974		
		8° 56′			

Ex. 2. A ship from latitude 2° 5′ N., longitude 22° 30′ W., sails W. S. W. 256 leagues; required her present latitude and longitude.

Ans. Latitude 2° 49′ S.; longitude 34° 20′ W.

Ex. 3. A ship from latitude 34° 35′ N. and longitude 45° 16′ W.; course S. 83° 36 E.; distance 101 miles. Required the latitude and longitude in.

Ans. Latitude in 34° 24′ N.; longitude in 43° 15′ W.

Ex. 4. A ship from San Francisco in latitude 37° 48′ N; longitude 122° 27′ W., sails S. W. 200 miles. Required the latitude and longitude in.

Ans. Latitude in 35° 27′ N.; longitude in 125° 23′ W.

CASE III.

Both Latitude and Departure from the Meridian being given, to find the Course, Distance and Difference of Longitude.

Ex. 1. A ship in latitude 56° 50′ N., and longitude 20° 10′ W., sails south-easterly until she makes 210 miles departure, and her latitude in is 49° 15′ N. Required the course, distance and longitude in.

Latitude left	56° 50′ N.		56° 50′
Latitude in	49 15 N.		49 15
Dif. of latitude	7 35	Sum.	2)106 05
	60		53° 02′ Middle latitude.
	455 miles.		

TO FIND THE COURSE.		TO FIND THE DISTANCE.		TO FIND THE DIF. OF LONG.	
Dif. latitude 455	2.658011	Course 24° 47′ sine	9.622409	Mid. lat. 53° 02 cos	9.779128
Radius	10.000000	Dep. 210	2.322219	Dep. 210	2.322219
Dep. 210	2.322219	Radius	10.000000	Radius	10.000000
	12.322219		12.322219		12.322219
	2.658011		9.622409		9.779128
Course S. 24° 47′ E. tan.	9.66420	Distance 501	2.699810	Dif long. 60)349	2.543091
				5° 49′	
				Long sailed from	20° 10′ W.
				Dif. long.	5 49 E.
				Longitude in	14° 21′ W.

Ex. 2. A ship in latitude 4° 57′ N.; longitude 30° 10′ E., sails south-westerly until her departure is 740 miles, and her latitude in 2° S. Required her course, distance and longitude in.

Latitude left	4° 57′ N.	4° 57′ N.
Latitude in	2 S.	2 S.
Dif. of latitude	6 57′	2)2 57
	60	1° 28′ Middle latitude.
Difference latitude,	417 miles.	

TO FIND THE COURSE.		TO FIND THE DISTANCE.		TO FIND THE DIF. OF LONGITUDE.	
Dif. lat 417	2.620136	Course 60° 36′ sin.	9.940125	Mid. lat. 1° 28′ cos.	9.999858
Radius	10.000000	Departure 740	2.869232	Dep. 740	2.869232
Departure 740	2.869232	Radius	10.000000	Radius	10.000000
	12.869232		12.869232		12.869232
	2.620136		9.940125		9.999858
C'rse S. 60° 36′ W. tan.	10.249096	Distance 849	2.929107	Dif. long. 60)740	2.869374
				12° 20′ W.	
				Long. sailed from	30° 10′ E.
				Dif. longitude	12 20 W.
				Longitude in	17° 50′ E.

Ex. 3. A ship in latitude 49° 57′ N., and longitude 15° 16′ W., sails south-westerly until her departure is 789 miles, and latitude in is 39° 20′ N. Required course, distance, longitude in.

Ans. Course S. 51° 05′ W.; distance 1014 miles; longitude in, 33° 45′ W.

CASE IV.

Both Latitudes and Course given, to find the Departure, Distance and Difference of Longitude.

Ex. 1. A ship from latitude 49° 57′ N. and longitude 30° 00′ W., sails S.W. ½ S. and after sailing several days finds by observation that her latitude is 45° 31′ N. Required distance sailed and longitude in.

Turn the given course into degrees by Compass Table, find the departure, distance, and then the difference of longitude.

Latitude left......	49° 57′ N.	49° 57′ N.
Latitude in.......	45 31 N.	45 31 N.
	4 26	2)95 28
	60	47 44′ Middle latitude.
	266 miles.	

TO FIND THE DEPARTURE.		TO FIND THE DISTANCE.		TO FIND THE DIF. OF LONGITUDE.	
Radius	10.000000	Course 39° Cos.......	9.890503	Mid. lat. 47° 44′ Cos..	9.827745
Dif. lat. 266..........	2.424882	Dif. lat. 266..........	2 424882	Departure 215.4	2.333251
Course 39°...... .tan.	9.908369	Radius	10.000000	Radius	10.000000
	12.333251		12.424882		12.333251
	10.000000		9.890503		9.827745
Dep. 215.4.....	2.333251	Distance 342.3.......	2.534379	Dif. lon. 60)320	2.505506
				5° 20′	
				Dif. lon........	5° 20′ W.
				Long. left....	30 00 W.
				Long. in...........	35° 20′ W.

Ex. 2. A ship from latitude 42° 25′ N. and longitude 15° 6′ W., sails N. E. by E. for two days and then finds by observation that she is in latitude 46° 20′ N.; required the distance she has made and the longitude in.

Ans. Departure, 351.7; distance, 423 miles; longitude in 6° 54′ W.

Ex. 3. A ship from Cape Flattery in latitude 48° 23′ N., longitude 124° 22′ W., sails until she is in latitude 40° 10′ N,; her course is S. W. ½ W.; find longitude in and distance made.

Ans. Longitude in, 138° 21′ W.; distance, 777 miles.

Ex. 4. A ship from Cape Mendocino in latitude 40° 29′ N., longitude 124° 29′ W., sails S. W. by W. until she is in latitude 34° 18′ N.; required distance and longitude in.

Ans. Distance, 668; longitude in, 136° 08′ W.

CASE V.

Both Latitudes and Distance given, to find the Course and Difference of Longitude.

Ex. 1. A ship sails from latitude 6° 50′ N., south-easterly 800 miles, when she arrives in latitude 5° 00′ S. Required her course and difference of longitude.

Latitude left......	6° 50′ N.	Half	3° 25
Latitude in.......	5 00 S.	Half	2 30
	11° 50′		2)5 55
	× 60		
			2° 57′ Middle latitude.
	710 miles.		

TO FIND THE COURSE.

As the distance 800..................	2.903090
Is to radius..........................	10.000000
So is dif. of lat. 710..................	2.851258
	12.851258
	2.903090
To co-sine of course S. 27° 26′ E.......	9.948168

TO FIND THE DIFFERENCE OF LONGITUEE.

As co-sine mid. lat. 2° 57′............	9.999424
Is to tang. of course 27° 26′.....	9.715242
So is dif. lat. 710....................	2.851258
	12.566500
	9.999424
Difference of longitude 369..........	2.567076

Ex. 2. A ship from latitude 56° 30′ N. has sailed south-easterly 257 miles, when she arrives in latitude 54° 47′ N. Required the course and difference of longitude.

Ans. Course S. 66° 22′ E.; difference of longitude 417 miles.

Ex. 3. A ship sails from the latitude of 3° 20′ N. and longitude 29° 37′ W., 960 miles south-westerly, and then by observation finds that her latitude is 10° 40′ S. Required the course and longitude in.

Ans. Course S. 29° 00′ W.; longitude in 37° 24′ W.

Ex. 4. A ship sails from Santa Clara in latitude 3° 14′ S. north-westerly 300 miles, until it is found by observation that she is on the equator. Required the course and difference of longitude.

Ans. Course N. 49° 43′ W.; difference of longitude 3° 49′ W.

CASE VI.

One Latitude, Course and Departure given, to find the Distance and Difference of Latitude and Difference of Longitude.

Ex. 1. A ship sails E. S. E. from latitude 50° 10′ S. and longitude 30° 00′ E. until her departure is 957 miles; required distance sailed, and latitude and longitude in.

(From Compass Table the course E. S. E. is 67° 30′.)

FIRST: TO FIND THE DIF. OF LATITUDE.

As sine of course 67° 30′...........	9.965615
Is to departure 957..................	2.980912
So is co-sine of course 67° 30′.....	9.582840
	12.563752
	9.965615
To dif. of latitude, 60)396.4....	2.598137
6° 36′	

SECOND: TO FIND LAT. IN.

Lat. left......	50° 10′ S.
Dif. of lat....	6 36 S.
Lat. in.......	56° 46′ S.

Lat. left....	50° 10′ S.
Lat. in.....	56 46 S.
Sum......	.2)106° 56′
Middle lat..	53° 28′

THIRD: TO FIND THE DISTANCE.

As sine of course 67° 30′.............	9.965615
Is to the departure 957′..............	2.980912
So is radius...........................	10.000000
	12.980912
	9.965615
To the distance 1036..................	3.015297

FOURTH: TO FIND DIFFERENCE OF LONGITUDE.

As co-sine mid. lat. 53° 28′...........	9 774729
Is to the departure 957′	2.980912
So is radius.........................	10.000000
To dif. of lo.n, 60)1608	3.206183
26° 48′ E.	
Longitude left..............	30° 00′ E.
Difference of longitude.............	26 48 E.
Longitude in........................	56° 48′ E.

Ex. 2. A ship sails S. S. W. from latitude 51° 15′N., and longitude 9° 50″ W., until her departure is 250 miles. Required the distance sailed and the latitude and longitude in.

Ans. Latitude in, 41° 12 N.; longitude in, 15° 51′ W.; distance, 653.3

Ex. 3. A ship from latitude 38° 40′ S., and longitude, 1° 15′ W., sails N. E. ½ E. until her departure is 250 miles. Required the latitude and longitude in.

Ans. Latitude in, 35° 14′ S.; longitude in, 3° 57′ E.; distance, 324 miles.

Ex. 4. A ship from latitude 30° 15′ S., longitude, 178° 10′ E., sails on a course N. 4 points E. until her departure is 150 miles. Required the distance sailed and longitude and latitude in.

Ans. Distance sailed, 212 miles; latitude in, 27° 45′ S., and longitude, 178° 58′ W.

CASE VII.

One Latitude, Distance, and Departure given, to find the Course, Difference of Latitude, and Difference of Longitude.

Ex. 1. A ship from latitude 49° 30′ N. and longitude 25° 00′ W., sails south-easterly 645 miles until her departure is 500 miles. Required the course steered, and her latitude and longitude in.

FIRST: TO FIND THE COURSE.

As distance 645 miles......	2.809560
Is to radius	10.000000
So is departure 500..	2.698970
	12.698970
	2.809560
To sine of c'rse S. 50° 49′ E.	9.889410

SECOND: TO FIND DIF. OF LATITUDE.

As radius..................	10.000000
Is to distance 645..........	2.809560
So is co-sine of c'rse 59° 49′	9.800582
	12.610142
	10.000000
To dif. of latitude 60)408..	2.610142
6° 48′ S.	

THIRD: LAT. IN AND MID. LAT.

Lat. left.	49°	30′	N.
Dif. of lat	6	48	S.
Lat. in...	42	42	N.
Sum..	2)92	12	
Mid. lat	46	6	

FOURTH: TO FIND DIFFERENCE OF LONGITUDE.

As co-sine mid. lat. 46° 06...	9.840985
Is to departure 500 miles............	2.698970
So is radius.........................	10.000000
	12.698970
	9.840985
To difference of longitude 60)721....	2.857985
12° 01′ E.	

FIFTH: TO FIND THE LONGITUDE IN.

Longitude left......................	25° 00′	W.
Difference of longitude............	12 01	E.
Longitude in.......................	12° 59′	W.

Ex. 2. A ship from latitude 54° N. and longitude 33° 20′ W., sails 350 miles between north and east, until she has made 220 miles of departure. Required the course, and latitude and longitude in.

Ans. Course, N. 38° 57′ E.; latitude in, 58° 32′ N.; and longitude, 26° 44′ W.

Ex. 3. A ship from latitude 23° 50′ N.; longitude 23° 30′ W., sails between the south and west, 375 miles, until her departure is 200 miles. Required the course, latitude and longitude in.

Ans. Course, S. 32° 14′ W.; latitude in, 18° 33′ N.; longitude in, 27° 05′ W.

CASE VIII.

One Latitude, Departure, and Difference of Longitude given, to find the other Latitude, Course and Distance.

Ex. 1. A ship from latitude 37° 00′ N., sails south-westerly until she has made 483 miles of departure, and 565 miles difference of longitude. Required her present latitude, course steered, and distance run.

TO FIND THE MIDDLE LATITUDE.

As dif. of longitude 565...............	2.752048
Is to radius..............................	10 000000
So is departure 483....................	2.683947
	12.683947
	2.752048
To co-sine mid. lat. 31° 15′...........	9.931899

Middle latitude................	31° 15′
	2
Double middle latitude.........	62 30
Latitude left..................	37 00 N.
Latitude in....................	25 30 N.
Diff. of latitude..............	11° 30′ = 690

TO FIND THE COURSE.

As difference of latitude 690′........	2.838849
Is to radius	10.000000
So is departure 483	2.683947
	12.683947
	2.838849
To tang. course 34° 59′...............	9.845098

TO FIND THE DISTANCE.

As radius............................	10.000000
Is to difference latitude 690	2.838849
So is sec. course 34° 59′...............	10.086547
	12.925396
	10.000000
To the distance 842....................	2.925396

Ex. 2. A ship sails from latitude 49° 30′ N., south-easterly until her departure is 167 miles, and difference of longiture is 252 miles. Required present latitude, course steered, and distance.

Ans. Latitude in, 47° 30′ N.; course, S. 54° 18′ E.; distance, 205 miles.

Ex. 3. A ship sails from latitude 50° 10′ S., between the south and east until her departure is 160 miles, and her difference of longitude 253 miles. Required her present latitude, course and distance.

Ans. Latitude in, 51° 16′ S.; course, E. S. E.; distance, 175.2 miles.

GENERAL RULES—TABLES III AND IV.

Solutions of the different cases by Inspection.

If seeking a course which is under 45° it will be found at the top of the pages, but if it is over 45° it will be found at the bottom of the pages. If the departure, or difference of latitude, or distance, are too great to be found in the tables, divide them by 10 or by 100, and then multiply the quantities found (not the course or middle latitude) by the same number you used in dividing. To find the difference of longitude, use either of these two methods. (In looking in the table use the nearest number and nearest angle.) With the middle latitude as a course, and the departure in the latitude column, the difference of longitude will be found in the distance column. Or with the co-middle latitude (90° lat.) as a course, and with the difference of latitude in its own column, or the departure in its own column, will be found the difference of longitude in the distance column.

CASE 1. Look for the middle latitude 23° as if it were a course, and for 132.3 (one-tenth the difference of longitude) in the distance column, opposite to which in the difference of latitude column will be found 121.5 which being multiplied by 10, gives 1215 the departure. With 12.15 (one hundredth the departure) in the departure column and 33.23 (one hundredth of the difference of latitude) in the latitude column, will be found at the top of the page 20° the course; and 35.00 in the distance column, which being multiplied by 100, gives 3500 the distance. This can be also solved by taking the co-middle latitude (90° 23′) 67° as a course and the difference of longitude in the distance column will be found the departure in the departure column. Then proceed as before.

Case 2. Look for the course 31° at the top of the page, and 96.0 (one-tenth the distance) in its column opposite to the distance, in their columns will be the difference of latitude 822 and the departure 494. Then with the middle latitude 23° as a course, and the departure 49.4 (one-tenth) in the difference of latitude column, will be found 54.0 in the distance column; this multiplied by 10, gives the difference of longitude, 540.

Case 3. Look in the departure and latitude columns until they are found nearly to agree, 45.3 and 21.1; the course is found at the top of the page, it is 25°. The distance, 50, is opposite in its column; this multiplied by 10, gives the correct distance, 500. With the middle latitude 53° as a course, and one-tenth the departure in the latitude column, 35 is found in the distance column; this multiplied by 10, gives 350, the difference of longitude.

Case 4. With the course 39°, and one-tenth the difference of latitude, 26.6 in its column, in the departure column will be found 21.4, and in the distance column 34; these multiplied by 10, give the departure 214 and the distance 340. Then with the middle latitude, 48° as a course, and with 21.4 in the latitude column, 32 will be found in the distance column; this multiplied by 10, gives 320 for difference of longitude.

Case 5. With one-tenth the distance, 80, and one-tenth the difference of latitude, 71, in their columns at the top of the page, the course 27° will be found. Then with the middle latitude 1° (nearly) as a course, and the departure 36.3 in the latitude column, the difference of longitude, 36.3, (one-tenth) will be opposite in the distance column.

Case 6. Find the course 67°, and one-tenth the departure, 95.7 in its column, these will be in the latitude and distance columns, 104 and 40.6, but as this course is 67° 30′, take half the sum columns of 67° and those of 68°; this will give the correct difference of latitude 396, (39.6 multiplied by 10) and the correct distance 1035, (103.5 × 10), then with the middle latitude as course, and departure in latitude column, the difference of longitude 1590 will be found in the distance column.

Case 7. With one-tenth the distance and departure, 64.5; 50, agreeing in their columns, the course, 51°, will be found, and at the same time the difference of latitude 408 (40.8 × 10) in its column. Then with the middle latitude 46° as a course, and the departure 50 (one-tenth) in the latitude column, one-tenth of the difference of longitude will be found in the distance column 720, (72 × 10).

Case 8. With one-tenth the difference of longitude, 56.5 in the distance column, and one-tenth the departure, 48.3 in the latitude column agreeing, will be found the middle latitude 31°, at the top of the page. Then with the difference of latitude in its column, and the departure in its columns will be found the course, 35°, at the top of the page, and the distance 850 in the distance column.

LOGARITHMIC SINES, TANGENTS AND SECANTS.

This table contains the logarithmic, or, the artificial sines, tangents and secants, to each degree and minute of the quadrant, with their complements or co-sines, co-tangents and co-secants, to six places of figures, besides the index; but it may be observed, as of the last table, that five places being generally sufficient in the common practice of navigation, when the sixth is omitted, and it is five or above, the preceding or fifth figure is to be increased by a unit.

To find the Logarithmic Sine, Co-sine, etc., of any given Arc in Degrees and Minutes.

If the given degrees be under 45°, they are to be taken from the top, and the minutes from the left side column; opposite to which, in that column with the name of the logarithm at top, will be found the required logarithm.

But if the degrees be more than 45°, they will be found at the bottom of the page, and the minutes in the right-side column; likewise the name of the logarithm is to be taken from the bottom of the page.

When the given degrees exceed 90°, they are to be subtracted from 180° degrees, and the logarithm of the remainder taken out as before, or the logarithmic sine, tangent, etc., of an arc more than 90° is the logarithmic co-sine, co-tangent, etc., of its excess above 90°.

To find the Arc in Degrees and Minutes nearest corresponding to a given Logarithmic Sine, Co-sine, etc.

Look in the column marked at the top or bottom with the name of the given logarithm, and, when the nearest to it is found, the corresponding degrees and minutes will be those required; observing, that when the name is at the top of the column, the degrees are to be taken from the top, and the minutes from the left-side column; but, if the name be at the bottom, the corresponding degrees will be there likewise, and the minutes in the right-side column.

MERCATOR'S SAILING.

Case 1.

To find the Course and Distance by Mercator's Sailing.

To this sailing apply the same rules as in middle latitude sailing, for finding difference of latitude and difference of longitude.

To get the meridional difference of latitude enter Table V, with degrees sought at top of column, and miles in the left-hand side marked miles, and opposite miles and under degrees will be found the meridional number required.

Having taken out the meridional parts for both latitudes, add or subtract them in the same manner as adding or subtracting to find the true difference of latitude, and the sum or difference will give the meridional difference of latitude. Then proceed as per example.

Note.—Tables required for working Mercator's Sailing.—Tables I, II, and V.

The Latitudes and Longitudes of Two Places given, to find the Course and Distance between them.

Ex. 1. Required the course and distance from Buena Vista to Rio Janeiro.

Latitude Buena Vista	15° 57′ N.	Longitude	22° 53′ W.
Latitude Rio Janeiro	22 54 S.	Longitude	43 16 W.

Lat. Buena Vista	15° 57′ N.	Meridional parts..	970	Long. Buena Vista	22° 53′ W
Lat. Rio Janeiro	22 54 S.	Meridional parts..	1412	Long. Rio Janeiro	43 16 W
Diff. Latitude	38 51	Mer. Diff. Lat....	2382	Diff. Long....	20 23
	60				60
In miles	2331			In miles	1223

TO FIND THE COURSE.		TO FIND THE DISTANCE.	
As mer. diff. lat. 2382......	3.376942	As radius.................	10.000000
Is to radius.................	10.000000	Is to prop. diff. lat. 2331...	3.367542
So is diff. long. 1223.. ...	3.087426	So is secant course 27° 11′..	10.050830
	13.087426		13.418372
	3.376942		10.000000
To tang. course S 27° 11′ W	9.710484	To distance 2620..	3.418372

Ex. 2. Required the course and distance from A. to B.

Lat. of A.....	50° 30′ S.
Lat. of B.....	48 20 S.
	2 10
×	60
In miles	130

Meridional part....	3521
Meridional part....	3322
Mer. dif. of lat.....	199

Longitude...	147° 50′ W.
Longitude...	138 58 E.
	286 48
	360 90
	73 12
×	60
In miles	4392

TO FIND THE COURSE.

As mer. dif. of lat. 199.....	2.298853
Is to radius................	10.000000
So is dif. of long. 4392......	3.642662
	13.642662
	2.298853
To tang. of course N 87° 24′ W	11.343809

TO FIND THE DISTANCE.

As radius.................	10.000000
Is to prop. dif. of lat. 130...	2.113943
So is secant of course. 87° 24′	11.343298
	13.457241
	10.000000
To the distance 2866........	3.457241

Ex. 3. Required the course (in degrees and miles) and distance from A. to B.
Latitude of A.... 55° 22′ N............Longitude.... 7° 24′ W.
Latitude of B.... 49 40 N............Longitude.... 53 54 W.
Ans. Course S. 78° 35′ W.; distance 1728.

Ex. 4. Required the course (in degrees and miles) and distance from A. to B.
Latitude of A.... 44° 44′ N............Longitude.... 63° 36′ W.
Latitude of B.... 33 07 S.............Longitude.... 17 58 E.
Ans. Course S. 43° 44′ E.; distance 6464.

Ex. 5. Required the course (in degrees and miles) and distance from C to D.
Latitude of C.... 54° 32′ S.............Longitude.... 36° 12′ W.
Latitude of D.... 38 54 S.............Longitude.... 143 40 E.
Ans. Course N. 82° 42′ E.; distance 7382.

CASE II.

One Latitude, Course and Distance given, to find the difference of Latitude and difference of Longitude.

Ex. 1. A ship from latitude 52° 06′ N. and longitude 35° 06′ W., sails N. W. by W. (56° 15′) 229 miles. Required the latitude and longitude in.

TO FIND THE DIFFERENCE OF LAT.

As radius..................	10.000000
Is to distance 229...........	2.359835
So is co-sine of course 56° 15′	9.744739
	12.104574
	10.000000
To dif. of lat. 60)127.2......	2.104574
2° 07	

TO FIND THE LATITUDE IN.

Lat. left	52° 06′ N....Mer. pts.	3675
Dif. of lat	2 7 N.	
Lat. in...	54° 13′ N....Mer. pts.	3887
	Mer dif of lat.	212

TO FIND THE DIFFERENCE OF LONG.

As radius..................	10.000000
Is to mer. dif. of lat. 212....	2.326336
So is tang. of course 56° 15′	10.175107
	12.501443
	10.000000
To dif. of long. 60)317.3....	2.501443
5° 17′	

TO FIND THE LONGITUDE IN.

Longitude left..............	35° 06′ W.
Dif. of long................	5 17 W.
Longitude in..............	40° 23′ W.

Ex. 2. A ship from latitude 42° 30′ N. and longitude 58° 51 W., sails S. W. by S. 591 miles. Required the latitude and longitude in.

Ans. Latitude 34° 19′ N.; longitude 65° 51′ W.

Case III.

Both Latitudes and Departure given, to find the Course, Distance and Difference of Longitude.

A ship from latitude 9° 10′ N. and longitude 19° 32′ W., sails in the S. E. quarter until she has made 415 miles of departure, and is by observation in latitude 2° 19′ S. Required her course, steered, distance run, and longitude in.

Note.—Find first proper difference of latitude, meridional difference of latitude, course, distance, difference of longitude and longitude in.

Latitude left......	9° 10′ N............	Mer. parts......	552.
Latitude in.......	2 19 S............	Mer. parts......	139.
	11° 29′	Mer. dif. of lat.	691.
	× 60		
In miles	689		

TO FIND THE COURSE.	
As dif. of lat. 689..........	2.838219
Is to radius................	10.000000
So is departure 415.........	2.618048
	12.618048
	2.838219
To tang. of course S. 31° 04′ E	9.779829

TO FIND THE DISTANCE.	
As sine of course 31° 04′.....	9.712679
Is to departure 415.........	2.618048
So radius..................	10.000000
	12.618048
	9.712679
To the distance 804.2.......	2.905369

TO FIND THE DIFFERENCE OF LONG.	
As radius.................	10.000000
Is to mer. dif. of lat. 691....	2.839478
So is tang. of course 31° 04′..	9.779818
	12.619296
	10.000000
To dif. of long. 60)416.2 E.	2.619296
6° 56′ E.	

TO FIND THE LONGITUDE IN.	
Longitude left............	19° 32′ W.
Dif. of longitude 416′......	6 56 E.
Longitude in........	12° 36′ W.

Ex. 2. A ship from latitude 49° 57′ N. and longitude 15° 16′ W., sails southwesterly until her departure is 789 miles, and is in by observation, latitude 39° 20′ N. Required her course, distance and longitude in.

Ans. Course S. 51° 05′ W.; longitude in 33° 50′ W.; distance 1014 miles.

Ex. 3. A ship from latitude 49° 57′ N. and longitude 5° 11′ W., sails between the south and west until she arrives in latitude 38° 27′ N., and finds she has made 440 miles of departure. Required the course she has steered, distance run and longitude the ship is in.

Ans. Course S. 32° 31′ W.; distance 818.5 miles; longitude in 15° 27′ W.

CASE IV.

Both Latitudes and Course given, to find the distance and Difference of Longitude.

Ex. 1. A ship from latitude 49° 57′ N. and longitude 30° 00′ W., sails S. W. $\frac{1}{2}$ S. for several days, and then finds by observation that she is in latitude 45° 31′ N. Required the distance she has made and her present longitude.

NOTE.—First find proper difference of latitude, meridional difference of latitude, distance, difference of longitude and longitude in.

Latitude left......	49° 57′ N............	Mer. parts......	3470.
Latitude in.......	45 31 N............	Mer. parts......	3074.
	4° 26′		396
	60		
In miles	266		

TO FIND THE DISTANCE.

As co-sine of course 39° 22′..	9.888237
Is to dif. of lat. 266.........	2.424882
So is radius................	10.000000
	12.424882
	9.888237
To the distance 344.1.......	2.536645

TO FIND DIFFERENCE OF LONGITUDE.

As radius..................	10.000000
Is to mer. dif. of lat. 396....	2.597695
So is tang. of course 39° 22′..	9.914044
	12.511739
	10.000000
To dif. of long. 60)324.9....	2.511739
5° 24′	

Longitude left...........	30° 00′	W.
Difference of longitude....	5 24	W.
Longitude in.............	35° 24′	W.

Ex. 2. A ship from latitude 42° 40′ N. and longitude 16° 20′ W., sails N. E., and then finds by observation that she is in latitude 50° 50′ N. Required the distance sailed, and present longitude.

Ans. Distance, 693 miles; longitude in, 4° 23′ W.

Ex. 3. A ship from latitude 30° 10′ N. and longitude 5° 10′ E., sails S. by E., and then finds by sun's observation that she is in latitude 42° 25′ S. Required the distance sailed and longitude in.

Ans. Distance, 1440 miles; longitude in, 20° 48′ E.

Ex. 4. A ship from latitude 42° 25′ N. and longitude 15° 06′ W., sails N. E. by E., and finds by observation that she is in latitude 46° 20′ N. Required the distance sailed, and longitude in.

Ans. Distance, 423 miles; longitude in, 6° 54′ W.

CASE V.

Both Latitudes and Distance given, to find the Course and Difference of Longitude.

Ex. 1. A ship from latitude 50° 30′ N. has sailed south-easterly 300 miles, when she arrives at latitude 45° 40′ N. Required her course steered, and difference of longitude.

NOTE.—First find proper difference of latitude, meridional difference of latitude, course, and difference of longitude.

Latitude left..............	50° 30′ N.	Meridional parts................	3521
Latitude in..............	45 40 N.	Meridional parts................	3087
	4° 50′	Mer. diff. of lat...............	434
	× 60		
In miles..................	290		

TO FIND THE COURSE.		TO FIND DIFFERENCE OF LONGITUDE.	
As the distance, 300.........	2.477121	As co-sine of course, 14° 50′.	9.985280
Is to radius...............	10.000000	Is to mer. dif. of lat., 434...	2.637490
So is dif. of lat., 290.........	1.462398	So is sine course, 14° 50′....	9.408254
	12.462398		12.045744
	2.477121		9.985280
To co-sine of course 14° 50′..	9.985277	To dif. of long., 114.9......	2.060464

Ex. 2. A ship from latitude 36° 20′ N., and longitude 22° 30′ W., sails S. by W. 960 miles and finds her latitude is 10° 40′ S. Required the course and longitude in.

Ans. S. 28° 57′ W., and longitude in, 30° 17′ W.

Ex. 3. A ship from latitude 56° 30′ N. has sailed south-easterly 257 miles, when she arrives at latitude 54° 47′ N. Required the course steered, and difference of longitude.

Ans. Course, S. 66° 22′ E.; difference of longitude, 418.2.

CASE VI.

One Latitude, Course, and Departure given, to find the Distance, Difference of Latitude and Difference of Longitude.

Ex. 1. A ship from latitude 50° 10′ S., and longitude 30° 00′ E., sails E. S. E., until her departure is 957 miles. Required the distance sailed and her present latitude and longitude.

NOTE.—First find the difference of latitude, latitude in, and meridional difference of latitude, the distance and difference of longitude.

TO FIND DIFFERENCE OF LATITUDE.

As sine of course 67° 30′....	9.965615
Is to departure 957′....... ..	2.980912
So is co-sine of course 67° 30′	9.582840
	12.563752
	9.965615
To dif. of lat. 60)396.4	2.598137
6° 36′ S.	

TO FIND THE DISTANCE.

As sine of course 67° 30′....	9.965615
Is to departure 957′.........	2.980912
So is radius...............	10.000000
	12.980912
	9.965615
To the distance 1036........	3.015297

Lat. left..	50° 10′ S.	Mer. dif. of lat..	3490
Dif. of lat.	6 36 S.		
Lat. in. ..	56° 46′ S.	Mer. dif. of lat..	4157
		Mer. dif. of lat..	667

TO FIND DIFFERENCE OF LONGITUDE.

As co-sine of course 67° 30′..	9.582840
Is to mer. dif. of lat. 667....	2.824126
So is sine of course 67° 30′...	9.965615
	12.789741
	9.582840
To dif. of long. 60)1610	3.206901
26° 50′	

Longitude left......	30° 00′ E.
Difference of longitude.....	26 50 E.
Longitude in......	56° 50′ E.

Ex. 2. A ship from latitude 51° 15′ N., and longitude 9° 50′ W., sails S. S. W. until her departure is 250 miles. Required the distance sailed, and latitude and longitude in.

Ans. Latitude in, 41° 11′ N.; longitude in, 15° 53′ W., and distance 653.3 miles.

Ex. 3. A ship from latitude 40° 20′ S., and longitude 20° 40′ E., sails N. N. E. until her departure is 500 miles. Required the distance sailed, and latitude and longitude in.

Ans. Latitude in, 28° 13′ S.; distance, 1307 miles; longitude in, 30° 24′ E.

CASE VII.

On Latitude, Distance, and Departure given, to find the course, Difference of Latitude, and Difference of Longitude.

Ex. 1. A ship from latitude 54° N. and longitude 33° 20′ W., sails 350 miles between north and east, until she has made 220 miles of departure. Required the course steered, and her present latitude and longitude.

NOTE.—First find the course, difference of latitude, latitude in and meridional difference of latitude, difference of longitude and longitude in.

TO FIND THE COURSE.

As the distance 350........	2.544068
Is to radius................	10.000000
So is departure 220.........	2.342423
	12.342423
	2.544068
To sine course 38° 57′.......	9.798355

TO FIND DIFFERENCE OF LATITUDE.

As radius..................	10.000000
Is to distance 350...........	2.544068
So is co-sine course 38° 57′..	9.890809
	12.434877
	10.000000
To difference latitude 272.2.	2.434877

Lat. left	54° 00′ N.	Mer. parts..	3865
Dif, lat.	4 32 N.		
Lat. in	58° 32′ N.	Mer. parts..	4355
		Mer. dif. lat.	490
Long. left	38° 20′ W.		
Dif. long.	6 36 E.		
Long. in	26° 44′ W.		

TO FIND DIFFERENCE OF LONGITUDE.

As co-sine course 38° 57.....	9.890809
Is to mer. dif. lat. 490......	2.690196
So is sine course 38° 57′.....	9.798403
	12.488597
	9.890809
To dif. long. 396.1..........	2.597790

Ex. 2. A ship in latitude 49° 30′ N. and longitude 25° W., sails south-easterly 215 miles, making 167 miles departure. Required the course steered, and latitude and longitude in.

Ans. Course, 50° 58′; latitude in 47° 15′ N.; longitude in 20° 50′ W.

Ex. 3. A ship in latitude 49° 30′ N. and longitude 25° 00′ W., sails south-easterly 645 miles, making 500 miles departure. Required the course steered, and latitude and longitude in.

Ans. Course, S. 50° 49′ E.; latitude in, 42° 42′ N.; longitude in, 12° 57′ W.

Case VIII.

One Latitude, Course and Difference of Longitude given, to find the Distance and Difference of Latitude.

Note.—This case cannot be solved by middle latitude sailing.

Ex. 1. A ship from latitude 34° 29′ N., sails S. 41° W., until the difference of longitude is 680 miles. Required latitude in and distance sailed.

Note.—First find meridional difference of latitude, then latitude in, and difference of latitude in miles, then the distance.

TO FIND MER. DIF. OF LATITUDE.

As radius 10.000000
Is to dif. long. 680.......... 2.832509
So is co-tang. course 41°.... 10.060837
12.893346
10.000000
To mer. dif. lat. 782.3...... 2.893346

Lat. left 34° 29′ N. Mer. parts 2207
Mer. dif. lat 782
Lat. in . . 23 06 N. Mer. parts 1425
Dif. lat. 11 23
60
In miles 683

TO FIND THE DISTANCE.

As co-sine course 41°........ ...... 9.877780
Is to dif. lat. 683.................. 2.834421
So is radius...................... 10.000000
12.834421
9.877780
To the distance 905′................ 2.956641

Ex. 2. A ship from latitude 50° 40′ S., sails N. 50° 00′ E., until her difference of longitude is 550 miles. Required the latitude in and distance sailed.

Ans. Latitude in, 45° 32′ S.; difference of latitude in miles 308; distance 479.2 miles.

MERCATOR'S SAILING.

Solutions of the Cases by Inspection.

Case I. Find the course from the tables by using the meridional difference of latitude, and difference of longitude, as difference of latitude and departure. Thus, with 23.8 in the latitude column, and 12.23 in the departure, 27° as a course will be found at the top of the page. With 27° as a course and the proper difference of latitude 23.31 (one hundredth) gives in the distance column 26, which multiplied by 100, gives 2600 as distance.

Case II. With the course three points at the top of the page and opposite the distance 59.1 (one-tenth) will be found the difference of latitude 49.1, which multiplied by 10, gives 491. Then with the same course and the meridional difference of latitude 628 in the latitude column, will be found the corresponding difference of longitude 42.0, which multiplied by 10, gives as difference of longitude 420.

Case III. With the proper difference of latitude 68.9 (one-tenth) and departure 41.5 (one-tenth) in their proper columns, find the course 31° at the top of the page, and the distance 800 in the distance column. Then, with this course 31°, and the meridional difference of latitude in the latitude column, the difference of longitude will be found in the departure column 41.4, multiplied by 10, gives 414.

Case IV. Find the course S. W. ½ S. among the points or degrees, and the proper difference of latitude 26.6, adjoining to which will be the distance 340 and departure 21.4 in their respective columns. Then, in the same table, find the meridional difference of latitude 396 in the latitude column, stands 321, in the departure column, which is the difference of longitude.

Case. V. Look in table IV until 30.0, one-tenth the distance, is found opposite 29.0, one-tenth the difference of latitude, in their columns. The course 15° is found at the top of the page, and the departure 78 (78×10) in the departure column. With 43.4, one-tenth the meridional difference of latitude in the latitude column, and the course 15°, the difference of longitude 116 (11.6×10) will be found in the departure column.

Case VI. Find the course 6 points at the bottom of the page, and the departure 96.7 (one-tenth) in its column, corresponding in their columns will be found the distance 1040 (104.0×10), and the difference of latitude 398 (39.8×10.) With the same course and the meridional difference of latitude 66.7 (one-tenth) in the latitude column, opposite in the departure column will be found the difference of longitude 1608 (160.8×10).

CASE VII. Look in the tables until the distance 35.0 (one-tenth) and the departure 22.0 (one-tenth) are found in their columns to nearly agree (if not to agree), opposite to them in the latitude column will be found the difference of latitude 2720 (27.20 × 10) and the course 39° at the top of the page. With this course and one-tenth the meridional difference of latitude 49.0 in the latitude column, 39.6 will be found adjoining in the departure column, this multiplied by 10, will give 396, the difference of longitude.

CASE VIII. With the course 41° at the top of the page, and the difference of longitude 68.0 (one-tenth) in the departure column, the meridional difference of latitude 785 will be found in the latitude column. Then with the difference of latitude 683 in its column, the distance 910 will be found in the distance column.

DEVIATION OF THE COMPASS.

Deviation of the compass is caused by the attraction of the iron in and on board the ship, such as her equipment, or cargo, etc. It depends, both for its amount and direction, on the position of the ship's head; it is named easterly when the north end of the needle is drawn, by the attraction of the ship's iron, to the right of the correct magnetic north, westerly when the north end of the needle is drawn to the left of the correct magnetic north.

Method for finding the Deviation.

Every ship ought to be provided with a good Azimuth Compass, which should be placed on the mid-ship line of the poop, or quarter deck, and as far as possible from all iron, and in such a position as to allow the bearings to be clearly observed. This is called the Standard Compass, and by it all bearings should be taken, and the Binnacle Compass frequently compared with it. When the ship is ready to proceed on a voyage, the deviation of the Standard Compass is to be ascertained by one of the following methods:

First method. By the known correct magnetic bearing of a distant object. Select an object, the correct magnetic bearing of which is known, and at not less than six or seven miles distant, if the ship be lying in a roadstead; but if in a dock a less distance will suffice, and swinging the ship's head very evenly, take the bearing of the object by the Standard Compass as the ship's head comes up to each point in succession, and the difference between the known and observed bearing will be the amount of deviation on each point of compass. (See table 1 for finding the deviation.)

The second method is fully explained in Table I (deviation card) with this difference only, that the correct magnetic bearing not having been given, it has to be found by taking the mean of the bearings of the distant object; this method of determining the deviation is sufficiently correct for practical purposes, but bear in mind that there is no such thing as an accurate "flying" bearing, and therefore it is preferable to swing the ship for adjustment while in a dock, or at anchor in a tide-way; and now to determine when the deviation is easterly or westerly. Rule: when the correct magnetic bearing of the distant object is to the right of the reading by compass on board, the deviation is east, and when to the left the deviation is west.

Thus, the rule is precisely the same as that for finding the variation of the compass from an Azimuth, or Amplitude, substituting correct magnetic for true bearing. The rule for applying the deviation is the same as that for applying the variation, that is, easterly to the right-hand and westerly to the left-hand.

When the deviation is to be added to the compass course to find the correct magnetic course made good, if the sum exceeds 90 degrees take it from 180 degrees, and the remainder will be named N. if previously S., but S. if previously N.; see example worked out·

Course by Standard Compass N. N. E. or N.	22° 30′ E.
Deviation by Standard Compass	20 20 E.
Correct magnetic course made good N.	42° 50′ E. or N. E. ¼ N.

Course by Standard Compass E. by N. or N.	78° 45′ E.
Deviation by Standard Compass	13 50 E.
	N. 92 35 E.
	180 00
Correct magnetic course made good S.	87° 25′ E. or E. ¼ S.

When the deviation is subtractive, and it exceeds the course, subtract the course from the deviation, and name the remainder East if the course is West; but West when the course is East.

Course by Standard Compass S. W. by S. or S.	33° 45′ W.
Deviation of Standard Compass	14 00 W.
Correct magnetic course made good	19° 45′ W., or S. by W. ¾ W.

Course by Standard Compass N. by W. or N.	11° 15′ W.
Deviation by Standard Compass	14 00 E.
	N. 2° 45′ E. or N. ¼ E.

VARIATION.

Next in order comes variation. We will say but little on the subject, as it is well understood by most seamen. Variation is the angle which the direction of the horizontal magnetic needle, when unaffected by deviaton, makes with the geographical meridian, and is named easterly when the magnetic north is to the right of the true north, and westerly when the magnetic north is to the left of the true north; and to know how to apply it, suppose yourself placed at the centre of the compass and looking directly forward to the point you are to allow the variation from, then, if the variation is easterly, allow it to the right-hand of the course steered; but, if westerly, to the left-hand. Precisely the same as deviation.

To find the True Course made good, with the Deviation on the Course steered, and the Variation proper to the locality.

If the deviation and variation are of the same name, take their sum; but, if one is east and the other west, take their difference and give the remainder the name of the greater quantity. Apply this sum or difference to the course steered, easterly to the right-hand, westerly to the left. (See example.)

Ex. 1.	Course steered W. S. W. or S.	67° 30′ W.	Deviation......	15° 00′ W.
	Correction..................	31 30 W.	Var. per chart..	16 30 W.
	True course................S.	36° 00′ W.	Correction (sum)	31° 30′ W.
Ex. 2.	Course steered N. E. or N....	45° 00′ E.	Deviation	22° 00′ E.
	Correction....................	2 40 E.	Var. per chart..	18 00 W.
	True course................N.	47° 40′ E.	Correction (dif.)	4° 00 E.

The True Course given to find the Compass Course to steer, knowing the Variation and Deviation.

The variation and deviation must be used separately; first, apply the variation to the true course to ascertain the correct magnetic course, and then find (from the deviation table) what compass course will make that correct magnetic.

The only exception to this method is when the variation and deviation are numerically the same, but have different names, in which case the one cancels the other, and the compass course is the true course. In shaping the course to steer, having given the true course, deviation and variation, apply them in the opposite way to which they were applied in finding the true course from the compass, that is easterly to the left, and westerly to the right.

Suppose the true course to be S. 40′ W., with a correction of deviation 5° 00′ E. and the variation 20° 00′ W. Subtract the easterly deviation from westerly variation and the net result will be 15° 00′ W. to apply to the right hand, that will give the magnetic course to steer S. 55° 00′ W. or S. W. by W.

First. A true course is the angle between the geographical meridian and the ship's real track on the surface of the sphere. Knowing the true course, it may be converted into a magnetic course by the application of the variation, viz: easterly variation to the left, westerly variation to right of the true course.

Second. A true bearing is the angle which the direction of an object makes with the geographical meridian. Knowing the true bearing, it may be converted into a magnetic bearing by the application of the variation, viz: easterly variation to the left, westerly variation to the right of the true bearing.

Third. A magnetic course is the angle which a ship's track makes with the magnetic meridian, as a magnetic bearing is the angle between the magnetic meridian and the direction of an object; such an angle can only be shown by a compass unaffected with deviation; but as the compasses of all iron ships have more or less deviation, and as any course steered, or bearing taken by any such compass is in a certain sense magnetic, it has been found necessary to distinguish these when corrected for deviation, as correct magnetic course or bearings.

Fourth. A compass course is the angle which the ship's track makes with the direction of the magnetic needle of the compass; such a course is affected with deviation and variation; applying the former, it becomes the correct magnetic course; applying both, it becomes the true course.

Fifth. A compass bearing is similarly the angle contained between the direction of the object and the direction of the magnetic needle of the compass; like the compass course, it is affected with deviation and variation; but the deviation to be applied in this case, is that due to the Azimuth of the ship's head, not that on the point of bearing; when this correction is made it becomes the correct magnetic, and the further application of the variation turns it into a true bearing; easterly deviation and variation to the right, westerly deviation and variation to the left.

Sixth. In "cross-bearings," both bearings must be corrected for the deviation due to the direction of the ship's head at the instant of making the observation. The correction or error of the compass obtained by means of an Amplitude or Azimuth of the Sun, or any celestial object, is the variation and deviation combined on the course or direction of the ship's head at the moment of making the observation; therefore, knowing the variation of the compass at any place, the deviation can readily be eliminated by one of the following rules:

First. If the correction is greater than the variation, subtract the variation from the correction, and the remainder, which is the deviation, will be the same name as the correction. Correction and variation of the same names both east or both west:

Ex. 1.	Correction	39° 00′ W.	Ex. 2.	Correction.........	30° 00′ E.
	Variation...	28 00 W.		Variation..........	22 00 E.
	Deviation........	11° 00′ W.		Deviation..........	8° 00′ E.

Second. If the correction is less than variation, subtract the correction from the variation, and the remainder, which is the deviation, will be east when the correction is west, but west when the correction is east.

Ex. 1.	Correction..... ..	17° 00′ W.	Ex. 2.	Correction.	10° 00′ E.
	Variation....... ..	30 00 W.		Variation....... ..	25° 00′ E.
	Deviation...... ..	13° 00′ E.		Deviation....... ..	15° 00′ W.

Correction and variation of different names, one east and the other west. Add together the correction and variation, their sum, which is the deviation, will be the same now as the correction.

Ex. 3.	Correction.	10° 00′ W.	Ex. 4.	Correction...... .	16° 00′ E.
	Variation....	5 00 E.		Variation.....	13 00 W.
	Deviation........	15° 00′ W.		Deviation.........	29° 00′ E.

Third. If the variation is 00° 00′ the correction is the deviation.

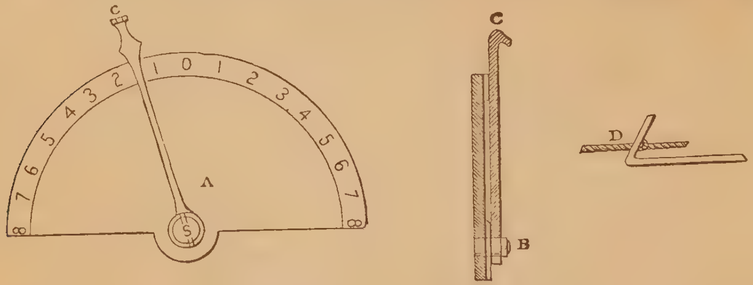
Fourth. If the correction is 00° 00′ the deviation is of the same amount as the variation, but of an opposite name; that is, east when the deviation is west, but west when the variation is east.

NOTE.—For correcting courses for deviation, see table 3, for deviation of Standard Compass, N. III.

LEEWAY.

When a ship is close-hauled and the wind blowing fresh, that part of the wind which acts upon the hull and rigging together with a considerable part of the force exerted on the sails, tend to drive her immediately from the direction of the wind, or as it is called to leeward; but as the bow of a ship exposes less surface to the water than the side, the resistance will be less in the first case than in the second; the velocity, therefore, in the direction of the head, will in most cases, be greater than the velocity in the direction of her side, and the ship's real course will be between the two directions. Now the angle contained between the line of the ship's apparent course, and the line she really describes through the water is termed the leeway.

The quantity of leeway to be allowed will depend upon a variety of circumstances, such as the mould or build of a ship, the draught or the trim of the ship, the quantity of sail she may be under, her speed through the water, and the sails being properly set and trimmed to the wind, etc. No general rule can, be laid down that will determine the quantity of leeway at all times. The most accurate method is to draw a semicircle on the taffrail with its diameter at right angles with the ship's keel, and apply as directed by the following plate:



The semicircle A. consists of a small piece of polished brass upon which the points of the compass are correctly laid off; this semicircle is attached to the taffrail of the ship. On the face of this semicircle or dial plate, we have a suitable pointer C., one end of which turns on the pin B., and to the other end we attach the line running to the log. It will be seen by the above sketch, the manner in which the log line is fastened to the pointer. When the log is to be drawn in, the line is slipped into the crutch and is held tight against the knot, as in sketch D., and the quantity of leeway is equivalent to the number of points indicated from the center line of the dial plate, which is to be applied to the ship's course as per rule. The leeway being determined it is to be allowed from the wind; that is, to the right of the course steered, when the wind is on the port side, and to the left when the wind is on the starboard side.

How to apply the Variation, Deviation and Leeway.

First. The calculator should suppose himself to be placed at the centre of the compass card, and looking outward in the direction of the ship's head; for example, suppose a ship is on the starboard tack with her head at north by compass, and the variation to be 2 points easterly, the deviation 2 points westerly and 1 point leeway; now 2 points east of north will give the course N.N.E., because easterly variation is always applied to the right hand; 2 points westerly deviation gives the course north again, because westerly deviation is always applied to the left hand, and 1 point leeway with the wind on the starboard side will give the corrected course N. by W., because the wind throws the ship to the left hand, (1 point).

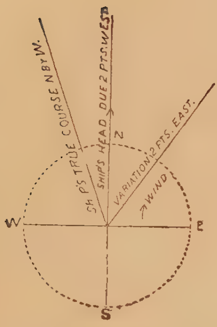
Second. Suppose a ship's head S.E. by compass variation $1\frac{1}{2}$ points east, deviation $1\frac{1}{4}$ points east and 2 points leeway, the wind being from the N.E. Now $1\frac{1}{2}$ points easterly variation gives S.S.E.$\frac{1}{2}$E.; $1\frac{1}{4}$ points easterly deviation gives S. by E.$\frac{1}{4}$E., and 2 points leeway with the wind from the eastward gives the course S.$\frac{3}{4}$W.

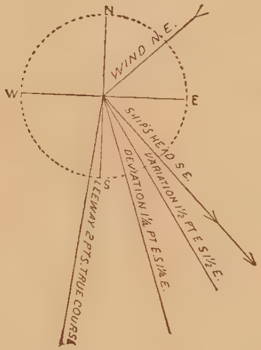
Third. Suppose a ship's head by compass to be N.N.W., the variation to be 2 points west, the deviation $1\frac{1}{2}$ points east, and leeway $\frac{3}{4}$ point, the wind being from the S.W., 2 points westerly variation gives N.W.; $1\frac{1}{2}$ points easterly deviation gives N.N.W.$\frac{1}{2}$W., and $\frac{3}{4}$ point leeway, wind from S.W. gives the course N. by W.$\frac{3}{4}$W.

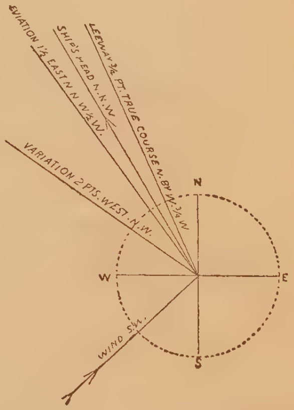
Easterly variation and easterly deviation go together; that is, to the right-hand; westerly variation and westerly deviation go together; that is, to the left-hand, and leeway from the wind.

The following examples, where the courses steered, and the variation, deviation and leeway to be allowed on each, are given, from thence to find the true courses, will serve to exercise the learner in the foregoing rules.

If any corrected course exceed 8 points or 90°, it must be subtracted from 16 points or 180°, and the name changed from north to south, or vice versa.






EVIATION 1½ EAST N N W ¾ W.
SHIP'S HEAD N.N.W.
LEEWAY ¾ PT. TRUE COURSE N. BY W. ¾ W
VARIATION 2 PTS. WEST. N.W.
WIND S.W.
N
W
E
S

Ex. 1. Ship' head N.; variation, 2 points E.; deviation, 2 points W.; leeway 1 point starboard tack.

Ex. 2. Ship's head S.E.; variation, 1½ point E.; deviation, 1¼ point E. and 2 points leeway; wind from N.E.

Ex. 3. Ship's head N.N.W.; variation, 2 points W.; deviation, 1½ point E.; leeway, ¾ point; wind from S.W.

These examples are marked out in degrees, instead of points, as it is more correct, so when points are given turn them into degrees and then apply deviation, variation and leeway, as per rules.

Ex 1. Given a ship's head, N. 85° 15′ W.; variation, 16° W.; deviation, 19° 41′ E.; leeway, 22° 30′; wind being from S. S. W.

Ship's head..................	N. 85° 15′	W.
Variation.....................	1	W.
	101° 15′	
	180	
	S. 78° 45′	W.
Deviation..................	19 41	E.
	98° 26′	
	80	
	N. 81° 34′	W.
Leeway......................	22 30	
True course..............	N. 59° 04′	W.

Ex. 2.

Ship's head.......	S. 78° 45′	E.
Variation	17	E.
	S. 61° 45′	E.
Deviation........	22 30	W.
	S. 84° 15	E.
W'd W.S.W. l'w'y.	5 45	
True course.... ..	S. 90° 00′	E.=East.

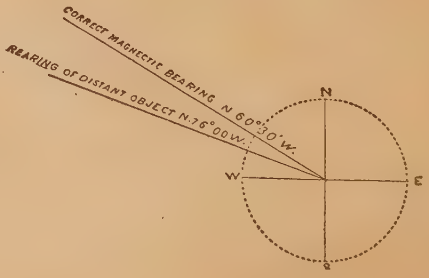
Courses Steered and Corrections Given.					To Find Corrected Course.
Courses steered.	Wind.	Variation.	Deviation.	Leeway.	Corrected course.
N. 30° 45′ E.	N. W.	11° 15′ W.	20° 30′ W.	11° 15′	N. 13° 15′ E.
N. 45° W.	N. E.	22° 30′ W.	18° E.	22° 30′	N. 72° 90′ W.
N. 45° E.	S. E.	19° 41′ W.	11° 15′ W.	33° 45′	N. 19° 41′ W.
S. 22° 30′ W.	West.	16° W.	22° 30′ W.	33° 45′	S. 49° 45′ E.
South.	E. by N.	22° 30′ W.	11° 15′ W.	22° 30′	S. 11° 15′ E.
N. 11° 30′ W.	W. N. W.	16° 45′ E.	22° 30′ E.	33° 45′	N. 61° 30′ E.

NO. 1.—TABLE FOR FINDING DEVIATION.

Form of registering the observations for determining the deviation of the Standard Compass by means of a known Correct Magnetic Bearing of a distant object. *Read the rules on deviation carefully.*

Ship's Head by Standard Compass.	Bearing of Distant Object from Standard Compass on Board.	Correct Magnetic Bearing of the Distant Object.	Deviation of Standard Compass.
North.	N. 76° 00′ W.	N. 60° 30′ W.	15° 30′ E.
N. by E.	N. 78 25 W.	" "	17 55 E.
N. N. E.	N. 80 50 W.	" "	20 20 E.
N. E. by N.	N. 81 10 W.	" "	20 40 E.
N. E.	N. 81 30 W.	" "	21 00 E.
N. E. by E.	N. 79 37 W.	" "	19 07 E.
E. N. E.	N. 77 45 W.	" "	17 15 E.
E. by N.	N. 74 02 W.	" "	13 32 E.
East.	N. 70 20 W.	" "	9 50 E.
E. by S.	N. 66 00 W.	" "	5 30 E.
E. S. E.	N. 61 40 W.	" "	1 10 E.
S. E. by E.	N. 57 35 W.	" "	2 25 W.
S. E.	N. 53 36 W.	" "	7 00 W.
S. E. by S.	N. 50 37 W.	" "	9 52 W.
S. S. E.	N. 47 45 W.	" "	12 45 W.
S. by E.	N. 46 22 W.	" "	14 07 W.
South.	N. 45 00 W.	" "	15 30 W.
S. by W.	N. 44 40 W.	" "	15 50 W.
S. S. W.	N. 44 20 W.	" "	16 10 W.
S. W. by S.	N. 44 53 W.	" "	15 35 W.
S. W.	N. 45 30 W.	" "	15 00 W.
S. W. by W.	N. 46 30 W.	" "	14 00 W.
W. S. W.	N. 47 30 W.	" "	13 00 W.
W. by S.	N. 49 00 W.	" "	11 30 W.
West.	N. 50 30 W.	" "	10 00 W.
W. by N.	N. 52 50 W.	" "	7 40 W.
W. N. W.	N. 55 10 W.	" "	5 20 W.
N. W. by W.	N. 58 20 W.	" "	2 10 W.
N. W.	N. 61 31 W.	" "	1 00 W.
N. W. by N.	N. 65 15 W.	" "	4 45 W.
N. N. W.	N. 69 00 W.	" "	8 30 W.
N. by W.	N. 70 30 W.	" "	12 00 W.

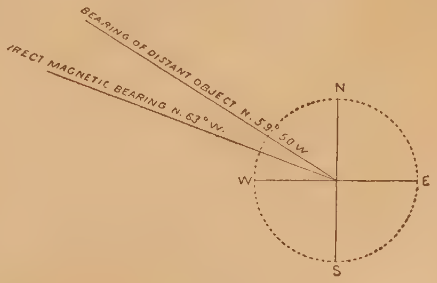
Name the deviation *east*, when the correct magnetic bearing stands to *right* of that taken on board, and *west* when to the *left*. Look at compass in this table.


CORRECT MAGNETIC BEARING N 60°30′ W.
BEARING OF DISTANT OBJECT N.76°00′W.
N
W
E
S

NO. 2.—TABLE FOR FINDING DEVIATION.

To determine the deviation at sea by the bearing of a distant object, its correct magnetic bearing being unknown, take the bearing of a distant object by compass, on 32 points, and divide the sum of the bearings by 32, the result will be the correct magnetic bearing, approximately. Then the difference between the correct magnetic and compass bearing on each point, will be the deviation. Name the deviation East, when the correct magnetic is greater than bearing from ship. Name the deviation West, when correct magnetic is less than bearing from ship. Remember that *easterly* deviation goes to the *right hand* and *westerly* to the *left hand.* Look at compass in this table.

Ship's Head by Standard Compass.	Bearing of Distant Object by Standard Compass.	Correct Magnetic Bearing.	Deviation of Standard Compass.
North.	N. 59° 50′ W.	N. 63° 00′ W.	3° 10′ W.
N. by E.	N. 65 35 W.	“ “	2 35 E.
N. N. E.	N. 71 10 W.	“ “	8 10 E.
N. E. by N.	N. 76 10 W.	“ “	13 10 E.
N. E.	N. 79 50 W.	“ “	16 50 E.
N. E. by E.	N. 82 30 W.	“ “	19 30 E.
E. N. E.	N. 83 30 W.	“ “	20 30 E.
E. by N.	N. 84 05 W.	“ “	21 05 E.
East.	N. 83 20 W.	“ “	20 20 E.
E. by S.	N. 82 15 W.	“ “	19 15 E.
E. S. E.	N. 81 05 W.	“ “	18 05 E.
S. E. by E.	N. 79 30 W.	“ “	16 30 E.
S. E.	N. 77 40 W.	“ “	14 40 E.
S. E. by S.	N. 75 05 W.	“ “	12 05 E.
S. S. E.	N. 72 40 W.	“ “	9 40 E.
S. by E.	N. 69 00 W.	“ “	6 00 E.
South.	N. 66 10 W.	“ “	3 10 E.
S. by W.	N. 63 05 W.	“ “	00 05 E.
S. S. W.	N. 60 00 W.	“ “	3 00 W.
S. W. by S.	N. 56 30 W.	“ “	6 30 W.
S. W.	N. 53 20 W.	“ “	9 40 W.
S. W. by W.	N. 50 00 W.	“ “	13 00 W.
W. S. W.	N. 46 50 W.	“ “	16 10 W.
W. by S.	N. 43 45 W.	“ “	19 15 W.
West.	N. 41 50 W.	“ “	21 10 W.
W. by N.	N. 39 40 W.	“ “	23 20 W.
W. N. W.	N. 39 00 W.	“ “	24 00 W.
N. W. by W.	N. 39 25 W.	“ “	23 35 W.
N. W.	N. 41 00 W.	“ “	22 00 W.
N. W. by N.	N. 44 00 W.	“ “	19 00 W.
N. N. W.	N. 48 10 W.	“ “	14 50 W.
N. by W.	N. 53 45 W.	“ “	9 15 W.
	32)2009° 45′(62° 48′		


BEARING OF DISTANT OBJECT N. 59° 50 W.
IRECT MAGNETIC BEARING N. 63° W.
N
W
E
S

Call the magnetic bearing 63° as there is 48′ over.

NO. 3.—DEVIATION TABLE FOR STANDARD COMPASS.

Ship's Head (or Course) by Standard Compass.	Deviation of the Standard Compass	Correct Magnetic Course made good by Steering as in the First Column.			
North.	15° 30′ E.	N. 15° 30′ E.	or	N. by E. ⅜ E.	nearly.
N. by. E.	18 20 E.	N. 29 35 E.	"	N. N. E. ⅝ E.	"
N. N. E.	20 20 E.	N. 42 50 E.	"	N. E. ¼ N.	"
N. E. by N.	21 15 E.	N. 55 00 E.	"	N. E. ⅞ E.	"
N. E.	21 00 E.	N. 66 00 E.	"	N. E. by E. ⅞ E.	"
N. E. by E.	19 45 E.	N. 76 00 E.	"	E. by N. ¼ N.	"
E. N. E.	17 15 E.	N. 84 45 E.	"	E. ½. N.	"
E. by N.	13 50 E.	S. 87 25 E.	"	E. ¼ S.	"
East.	9 50 E.	S. 80 10 E.	"	E. ⅞ S.	"
E. by S.	5 30 E.	S. 73 15 E.	"	E. by S. ½ S.	"
E. S. E.	1 10 E.	S. 66 20 E.	"	S. E. by E. ⅞ E.	"
S. E. by E.	3 10 W.	S. 59 25 E.	"	S. E. by E. ¼ E.	"
S. E.	7 00 W.	S. 52 00 E.	"	S. E. ⅝ E.	"
S. E. by S.	10 15 W.	S. 44 00 E.	"	S. E. ⅛ S.	"
S. S. E.	12 45 W.	S. 35 15 E.	"	S. E. ⅞ S.	"
S. by E.	14 30 W.	S. 25 45 E.	"	S. S. E. ¼ E.	"
South.	15 30 W.	S. 15 30 E.	"	S. by E. ⅜ E.	"
S. by W.	16 15 W.	S. 5 00 E.	"	S. ½ E.	"
S. S. W.	16 10 W.	S. 6 20 W.	"	S. ⅝ W.	"
S. W. by S.	15 40 W.	S. 18 05 W.	"	S. by W. ⅝ W.	"
S. W.	15 00 W.	S. 30 00 W.	"	S. S. W. ⅔ W.	"
S. W. by W.	14 20 W.	S. 41 55 W.	"	S. W. ¼ S.	"
W. S. W.	13 00 W.	S. 54 30 W.	"	S. W. ⅞ W.	"
W. by S.	11 30 W.	S. 67 15 W.	"	W. S. W.	"
West.	10 00 W.	S. 80 00 W.	"	W. ⅞ S.	"
W. by N.	7 50 W.	N. 86 35 W.	"	W. ⅓ N.	"
W. N. W.	5 20 W.	N. 72 50 W.	"	W. by N. ½ N.	"
N. W. by W.	2 20 W.	N. 58 35 W.	"	N. W. by W. ¼ W.	"
N. W.	1 00 E.	N. 44 00 W.	"	N. W. ⅛ N.	"
N. W. by N.	4 40 E.	N. 29 05 W.	"	N. N. W. ⅝ W.	"
N. N. W.	8 30 E.	N. 14 00 W.	"	N. by W. ¼ W.	"
N. by W.	12 15 E.	N. 1 00 E.	"	N. ⅛ E.	"

METHOD OF WORKING DEAD RECKONING, OR WHAT IS COMMONLY CALLED DAY'S WORK.

To Correct the Courses for Variation, Deviation and Leeway.

When the variation is westerly allow it to the left hand of the course steered. When variation is easterly allow it to the right hand of the course steered.

When the deviation is westerly allow it to the left hand of the course steered. When deviation is easterly allow it to the right hand of the course steered.

If an azimuth be observed, the correction will be the variation and deviation combined on the azimuth due the ship's head on that course.

To Correct the Course for Leeway.

When on the starboard tack allow the leeway to the left hand of the compass course. When on the port tack allow it to the right hand of the compass course.

First Course on Leaving the Land.

Take the bearing of an object, whose position, or latitude and longitude are known, and estimate its distance off shore as a distance, the opposite point to which is taken as a course, and being corrected for variation and deviation due the ship's head on that course.

This is entered in the traverse table along with the other courses.

If there is a current, the set and drift of which is known, allow the variation only on its set, and enter it in the traverse table as a course and distance.

Each course is to be corrected for variation, deviation and leeway, and entered in the traverse table, and set against each the distance run on that course.

Traverse Table.

Make a table which divide into six columns, in the first of these set down the several courses, and opposite to them in the second column enter the distance run on each course.

The third and fourth columns are to be marked north and south, and are to contain the difference of latitude.

The fifth and sixth are to be marked east and west, and to contain the departures.

Find the difference of latitude and departure corresponding to each course and distance in Table III; set these down in their proper columns; if the difference of latitude is north, it must be placed in the north column; and if south in the south column; if the departure is easterly place it in the east column, and if westerly place it in the west column.

When the course is due north, south, east or west, set down the distance in its respective column.

Sum up the columns of northing, southing, easting and westing, of each column separately, then if the northing be less than the southing, subtract it from the southing, and the remainder will be the whole difference of latitude made good, and of the same name as the greater; in the same manner the difference between the sums of the east and west column is the whole departure made, and of the same name as the greater.

Then the whole difference of latitude and departure will give the direct course and distance in Table IV.

To find the course and distance, with the difference of latitude and departure made good, enter Table IV; seek in the columns until they are found to agree; opposite to which will be found the distance in its column.

If the departure be greater than the difference of latitude, the course will be found at the bottom of the table, but if the departure be less than the difference of latitude, the course will be found at the top of the table.

To find Latitude in.

If the latitude of the place from which the departure has been taken and the difference of latitude made be both north or both south, their sum will be the latitude of the same name; but if the difference of latitude is of a contrary name to the latitude left, their difference will be the latitude in, and of the same name as the greater.

To find the Difference of Longitude.

Add together the latitude left and latitude in, and take half their sum for the middle latitude; then, with the middle latitude as a course, enter Table IV and seek for the departure made good in the latitude column, and in the distance column opposite, will be found the difference of longitude made, which divided by 60; if over 60, will give the degrees and minutes to be named east or west, according to the departure.

To find the Longitude in.

If the longitude left and difference of longitude made be both east or west, their sum will be the longitude in and of the same name; but if the difference of longitude be of contrary name to the longitude left, their difference will be the longitude in and of the same name as the greater; but when their sum exceeds 180° degrees the ship has *crossed the opposite meridian* to that of *Greenwich*, in that case subtract it from 360° degrees, and the remainder will be the longitude in of a *different name*. In example No. 1, the courses are given in points, the learner however, will derive greater advantage by turning the points into degrees, and practicing that system only, as it will facilitate the application of the variation and deviation which is generally given in degrees.

Ex. 1. A ship from a port in latitude 38° 42′ N., and longitude 51° 32′ W., bound to another port in latitude 43° 27′ N. and longitude 65° 19′ W., sails the following courses: S.W. ¾ W. 54 miles, S.W. by S. 38 miles, S. by E. ½ E. 37 miles, S.E. by E. ½ E. 40 miles, N. by E. ½ E. 50 miles, S. by E. ¼ E. 31 miles. Required the course, the distance and latitude and longitude in, also the course and distance to the port bound to by Mercator sailing.

Course.	Distance.	Diff. of Lat.		Departure.	
		N.	S.	E.	W.
S.W. ¾ W.	54		32.2		43.4
S.W. by S.	38		31.6		21.1
S. by E. ½ E.	37		35.4	10.7	
S.E. by E. ½ E.	40		18.9	35.3	
N. by E. ½ E.	50	47.8		14.5	
S. by E. ¼ E.	31		30.1	07.5	
			148.2	68.0	64.5
			47.8	64.5	

Course S. 2° 00′ E. = 100.4   3.5

Distance 101 miles.

The difference of latitude 100.4 miles and the departure 3.5, being looked for till they are found opposite each other in their respective columns in Table IV, gives the course S. 2° 00′ E., and the distance 101 miles.

To Find the Latitude and Longitude.

Latitude left	38° 42′ N.	Longitude left	51° 32′ W.
Difference of latitude	1 40 S.	Difference of longitude	05 E.
Latitude in	37° 02′ N.	Longitude in	51° 27′ W.
Sum	2)75 44		
Middle latitude	37° 52′		

The middle latitude as a course, and the departure in a latitude column, will give the difference of longitude in a distance column, 5 miles.

The course to the port bound to, will be found to be N. 58° 09′ W., and the distance 729.6. Work it out as per rule in case I, example 1, page 30.

CORRECT THE FOLLOWING COURSES FOR LEEWAY AND VARIATION.

GIVEN.				TO FIND ANSWER
Courses steered.	Winds.	Leeway.	Variation.	Courses correct'd
E.N.E.	N.W.	....	....	N.E. ½ E.
W. by S.	N.W. by N.	1	1½ W.	W.S.W.
N.W. by N.	N.E. by N.	1½	2 W.	W. by N. ½ N.
South.	E.S.E.	½	1¼ E.	S. by W. ¾ W.
N.W.	W.S.W.	2	1 W.	N.W. by N.
S.S.W.	S E.	1¼	1¼ W.	S.S.W.
E. by N.	N. by E.	2½	0¾ E.	S.E. by E. ¾ E.
West.	N.N.W.	¾	1 E.	W. ¼ N.

Ex. 2. April 11, 1876, Steamship "City of Panama," W. B. Seabury, Commander, from San Francisco, toward Victoria, at noon took our departure from Point Bonita in latitude 37° 49′ N., and longitude 122° 31 W.; bearing by compass E. ½S., distant 3 miles.

HOURS.	KNOTS.	10THS.	COURSES.	WINDS.	LEEWAY.	DEVIATION.
1	8	5	W. ½ N.	N. W.		
2	8	5		"		
3	6	5		"		
4	6	5		"		
5	6	5		"		
6	6	5		"		
7	6	5	N. W. by N. ½ N.	"		
8	6	5		"		
9	6	5		"		
10	6	5		"		
11	6	5		"		
12	6	5	N.W. by N.	"		
1	7	5		"		
2	7	5		"		
3	7	5		"		
4	6	5	N. by W. ½ W.	"		
5	6	5		"		
6	6	5		"		
7	6	5		"		
8	7	5	N. by W. ¾ W.	"		
9	7	5		"		
10	8	5		"		
11	8	5		"		
12	9	5		"		

COURSES.	DISTANCE.	N.	S.	E.	W.
N. 7½ W.	43	04.2	"	"	42.8
N. 2½ W.	33	29.1	"	"	15.6
N. 3 W.	28	23.3	"	"	15.6
N. 1½ W.	26	24.9	"	"	07.5
N. 1¾ W.	41	38.6	"	"	13.8
	Dif. of lat....	60)120.1		Departure..	95.3
		2° 00′ N.			

Latitude left.............	37° 49′ N.	Longitude left.......	122° 31′ W.
Difference of latitude	2 00 N.	Difference of longitude. ..	2 03 W.
Latitude in..............	39° 49′ N.	Longitude in.............	124° 34′ W.
Sum...........	2)77 38		
Middle latitude..........	38° 49		

True course, N. 38° 00′ W.; distance, 153 miles.

The middle latitude 38° 49′ (call it 39° 00′ as you have 49′ over) as a course in Table IV, and the departure 95′ in a latitude column, gives the difference of longitude 123 miles in a distance column, which divide by 60 gives 2° 03′ W., to be added to the longitude because the ship has been going to the westward.

Ex. 3.

Hours.	Courses.	Knots.	10ths.	Winds.	Leeway.	Deviat'n.	Remarks, Etc.
1	N. W. ¾ N.	3	5	S. W. ½ S.	¾	25° W.	A Point of Land.
2	"	3	5	"			In Latitude ...... 55° 57′ N.
3	"	3	5	"			In Longitude...... 16° 04′ W.
4	"	3	5	"			Bearing by Compass S. ¼ W.
5	W. S. W.	5	5	N. W. by N.	1	11° W.	Head South. Deviat'n 14° W.
6	"	5	5	"			
7	"	4	5	"			Distance 22 miles.
8	"	4	5	"			
9	W. by N. ½ N.	5	5	S. W. ½ W.	1¼	28° W.	
10	"	6	5	"			Variation 25° E.
11	"	6	5	"			
12	"	7	5	"			
1	N. E. ¾ E.	7	5	N. W. by N.	¾	20° E.	
2	"	7	5	"			
3	"	7		"			
4	"	7		"			
5	N. N. E.	7	5	N. W. by W.	1	11° E.	
6	"	6	5	"			
7	"	6	5	"			
8	"	6	5	"			
9	N. E. ½ E.	6	5	S. E. by E.	¾	20° E.	A Current set Correct Magnetic S. 22° E. 26 miles from the time the departure was taken to the end of the day.
10	"	6	7	"			
11	"	6	9	"			
12	"	5	9	"			

Bearing of Land.	First Course.	Third Course.	Fifth Course.
S. ¼ W. = S. 3° W. Opposite = N. 3° E. Dev. 14° W. Var. 25° E. } + 11° E. Cor. b'r'g, N. 14° E.	N.W. ¾ N. Leeway ¾ point to the right hand makes it into N.N.W. ½ W. = N. 28° W. Dev. 25° W. Var. 25° E. } = 0° Cor'd 1st. Course. } N. 28° W.	W. by N. ½ N. Leeway 1¼ point to the right hand makes it into N. W. by W. ¼ W. = N. 59° W. Dev. 28° W. Var. 25° E. } + 3° W. Cor'd 3rd Course. } N. 62° W.	N. N. E. Leeway 1 point to the right hand makes it into N. E. by N. = N. 34° E. Dev. 11° E Var. 25° E } + 36° E. Cor'd 5th Course. } N. 70° E.
Current.	**Second Course.**	**Fourth Course.**	**Sixth Course.**
S. S. E. = S. 22° E. Variation 25° E. Cor. Cur., S. 3° W.	W. S. W. Leeway 1 point to the left hand makes it into S. W. by W. = S. 56° W. Var. 25° E Dev. 11° W } + 14° E. Cor'd 2nd Course. } S. 70° W.	N. E. ¾ E. Leeway ¾ point to the right hand makes it into N. E. by E. ½ E. = N. 62° E. Var. 25° E Dev. 20° E } + 45° E. Cor'd Course. } N. 107° E. *exceeds* 90° Subtract from } 180° Cor'd 4th Course. } S. 73° E.	N. E. ½ E. Leeway ¾ point to the left hand makes it into N. E. ¼ N. = N. 42° E. Dev. 20° E Var. 25° E } + 45° E. Cor'd 6th Course. } N. 87° E.

Ans. True course, N. 66° E.; distance, 38 miles; difference of latitude, 15.2 departure, 34.6; latitude in, 56° 12′ N.; longitude in, 15° 02′ W.

Ex. 4.

HOURS.	COURSES.	KNOTS.	10THS.	WIND.	LEEWAY.	DEVIAT'N.	REMARKS.
1	S.E.¼S.	4	5	NE by E½E	8°	14° W.	Noon. A Point of Land. ——— in latitude 29° 02′ S. ——— in longitude 138° 02′ E. Bear'g by Comp—N. W. by W. Ship's he'd at 1st c'rse, per log. Distance 22 miles.
2	"	4	5	"			
3	"	4	5	"			
4	"	5	5	"			
5	S.E. by S.	7	5	S. W.	10°	18° W.	
6	"	6	5	"			
7	"	6	5	"			
8	"	6	5	"			
9	N.W.½N.	5	5	SW by W½ W	8°	3° E.	
10	"	5	5	"			Var. 11° E. (to the right hand)
11	"	4	5	"			
12	"	4	5	"			
1	W. by S.	5	5	South.	11°	14° E.	
2	"	4	5	"			
3	"	5	5	"			
4	"	4	5	"			
5	W. by N. ½N.	3	5	N.½E.	13°	13° E.	
6	"	3	5	"			A Curr'nt set } N. by W. ¾ W. by Comp'ss } (corr't magn'c) 20 miles from the time the departure was taken to the end of the day.
7	"	2	5	"			
8	"	2	5	"			
9	S.¾E.	4	5	E.½S.	12°	3° W.	
10	"	6	5	"			
11	"	7	5	"			
12	"	7	5	"			

TRUE COURSES.	DIST.	DIF. LATITUDE.		DEPARTURE.	
		N.	S.	E.	W.
S. 59° E.	22	"	11·3	18·9	"
N. 9 W.	20	19·8	"	"	3·1
S. 37 E.	19	"	15·2	11·4	"
S. 51 E.	27	"	17·0	21·0	"
N. 17 W.	20	19·1	"	"	5·8
N. 65 W.	20	8·5	"	"	18·1
N. 62 W.	12	5·6	"	"	10·6
S. 12 W.	26	"	25·4	"	5·4
		53·0	68·9	51·3	43·0
True Course.	Dist.		53·0	43·0	
S. 27° E.	18′	D. Lat	15·9	8·3	Dep.

Latitude left...... 29° 02′ S.
Dif. of Latitude... + 16 S.

Lat. in at Noon. .. 29° 18′ S.

Sum of Latitude... 58° 20′

Middle Latitude... 29° 10′

Longitude left.....168° 2′ E.
*Dif. of Longitude + 10 E.

Long. in at Noon. 168° 12′ E.

*The middle latitude 29° as a course, and the departure 8′·3 in a latitude column, give the difference of longitude 10′ (nearly) in a dist'ce col'mn.

TIME.

Time is measured by the motions of the heavenly bodies. Its divisions are years, months, days, hours, minutes and seconds. The day is the interval between two successive transits of the sun, moon, or a star over the same meridian.

The solar, or apparent day, is the interval between the sun's departure from, and its return to the same meridian. This day is divided into 24 hours, each hour into 60 minutes, and each minute into 60 seconds. The length of the day is subject to continual changes, owing to the obliquity of the plane of the sun's path to the equinoctial, and to the eccentricity of the earth's orbit. Astronomers, so as to have a uniform measure of time, use, what is named, a *mean solar day*, the length of this day is equal to the average of all the apparent solar days in a year; in other words, it is the day that would be shown by the sun if it moved uniformly in its path, the ecliptic.

As only apparent time can be obtained from observations, a correction must be applied to this in order to reduce it to mean time, this correction is called the equation of time. When it is required to reduce apparent time to mean time, the equation of time *must* be taken from the first page of the Nautical Almanac for the given month and opposite the given day.

This equation must be applied as directed at the head of its column. To find the corrected equation of time take it out of its column opposite the required day, also take out the hourly difference for the same day, and multiply it by the number of hours and decimals of an hour that are given as a part of that day, add this correction for hourly difference if the equation of time is increasing, or subtract if decreasing.

Suppose the apparent time is three hours P.M., March 5, 1878, at the meridian of Greenwich, that is, the sun has passed this meridian three hours, it is required to find the corresponding mean time.

March 5, 1878, equation of time, N. Alm.	11m: 40.95s.	Hourly. dif.	0.573
Correction for 3 hours, decreasing (sub.)	1.71		3
To be added to app. time +	11m: 39.24s.		1.719
Apparent time........................	3h: 00m: 00.00s.		
Mean time....	3h: 11m: 39.24s.		

When it is required to change mean into apparent time find the equation of time from the second page of the almanac for that month. Find the correction the same way as above, and apply the equation of time as directed at the head of the column.

March 5, 1878, mean time at the meridian of Greenwich 3hr. P.M. Required the apparent time.

March 5, 1878, equation of time, N. Alm.	11m: 41.06s.	Hourly dif.	0.573
Correction for 3 hours decreasing (sub.)	– 1.71s.		3
To be subtracted from mean time	11m: 39.35s.		1.719
Mean time...........................	3h: 00m: 00.00s.		
Apparent time......................	2h: 48m: 20.25s.		

There are three ways of reckoning time, called civil, astronomical and nautical, the last is now obsolete.

The civil day begins at midnight and ends the following midnight; it is divided into two parts, each of twelve hours; the first part is called A.M., meaning ante-meridian or before noon; the latter part is called P.M., meaning post-meridian or afternoon.

The astronomical day begins at noon and ends the following noon; that is, it begins 12 hours after the civil day, it is reckoned through the whole 24 hours from noon to noon. Thus from noon to midnight the day of the month and the hours of the day are the same for both methods, but from midnight to noon the civil day is 12 hours ahead of the astronomical day. So to turn A.M. civil time into astronomical time add 12 hours to it, and call it the day before, civil date, for example:

10 o'clock A.M., June 5, civil time, is June 4, 22, astronomical time, and 23 hours June 4, astronomical day, is 12 o'clock A.M. June 5, civil time.

All the computations of the Nautical Almanac are made for astronomical time at the meridian of Greenwich, it is therefore necessary, in taking quantities out of the almanac to reduce the ship's time to Greenwich time. One complete revolution of a heavenly body, over three hundred and sixty degrees of longitude takes place in 24 hours. This is at the rate of 15° in one hour of time, therefore at any place situated eastward of the meridian of Greenwich it will be noon before it is noon at the meridian of Greenwich, and at any place situated to the westward of Greenwich it will be noon after it is noon at the meridian of Greenwich. All the reduction of time must be made at the rate of 15° to an hour. The rule for applying longitude in time is this: Reduce the given longitude by multiplying by 4 and dividing by 6, Table XI, into time, and add it to the astronomical time of the given place, if the longitude in is west, and subtract it from the astronomical time if the longitude in is east, the sum or the remainder is the corresponding Greenwich time. If the longitude in is west, and the sum of the longitude in time, and the time at the given meridian is more than 24 hours, subtract 24 hours from it and call the remainder the time past noon of the day that follows. If the longitude in is east and the longitude in time is more than time at the given meridian, add 24 hours to the latter, and subtract the longitude in time, the remainder must be called the time past noon of the day before.

What will be the Greenwich time when it is 5 hours P.M. in longitude 50° W.

Time at the given meridian............	5h: 00m: P.M.
Longitude in time......	+3h: 20m: W.
Corresponding time at meridian Green..	8h: 20m.

Required the time at Greenwich when it is 7h:30m:15s: P.M., in longitude 100° 30′ E

Time at the given meridian..........	7h: 30m: 15s: P.M.
Longitude in time......	−6h: 42m: 00s: E.
Corresponding time at mer. Green...	0h: 48m: 15s.

Required the astronomical time at Greenwich corresponding to 7h:50m:25s: A.M., civil time; 145° 16′ W. longitude; May 5.

May 5.	Time at the given meridian......	7h: 50m: 25s: civil time.
		12h:
May 4.	....	19h: 50m: 25s: astron. time.
	Longitude in time.......	+9h: 41m: 04s: W.
		29h: 31m: 29s:
		24h: 00m: 00s:
May 5.	Astronomical time at Greenwich.	5h: 31m: 29s:

February 18; longitude 116° 37′ E.; time at ship, 11h:37m:14s: A.M. civil time; required the astronomical time.

Feb. 18.	Time at the given meridian....	11h: 37m: 14s: civil time.
		12h:
Feb. 17.	....	23h: 37m: 14s: astron. time.
	Longitude in time......	−7h: 46m: 28s: E.
Feb. 17.	Greenwich astronomical time..	15h: 50m: 46s:

May 17; in longitude 125° 25′ E.; astronomical time at ship, 3h: 10m; required the astronomical time at Greenwich.

May 17.	Time at ship............	3h: 10.00m: P.M.
		24h:
May 16.	....	27h: 10m:
	Longitude in time.......	−8h: 21m: 40s: E.
May 16.	Greenwich astron. time..	18h: 48m: 20s:

AMPLITUDE.

To find the Correction and Deviation of the Compass by an Amplitude.

(Table II, secant and sine for amplitude.)

First. To the apparent astronomical time at ship apply the longitude in time; adding west, and subtracting east longitude for the apparent astronomical time at Greenwich.

(NOTE.—Turn the degrees into time by multiplying the degrees by 4, and dividing by 60. Or by Table XI.)

Ex. 35° 25′
× 4
60)141° 40′
2h:21m:40s:

Second. P.M. time is astronomical; A.M. is civil time, and requires 12 hours added to make it astronomical time of the day before, (therefore add 12 hours when the time is A.M. and call it a day back) then apply the longitude; when west, add; when east, subtract.

Ex. June 20th, A.M. at ship time............ 9h:35m:
12h:
21h:35m:

Third. In adding west longitude the time may exceed 24 hours, when it is so take 24 hours from it, and call the day one more.

(NOTE.—Read carefully the rules on time.)

Fourth. In subtracting east, the longitude (in time) may exceed the time at ship; then borrow 24 hours to the time at ship, and subtract as before, but call the day one less, as you have borrowed a day by adding the 24 hours to the ship's time. This case only happens when it is P.M. at ship. For example: January 20, 6h:40m: P.M., and longitude in time 10h:40m: east, you require 24h: to the 6h: making 30h:40m: and take 10h:40m: from that, leaves 20h: on January 19. Again January 20, 6h:40m: A.M., you will always add 12h: to A.M., making 18h:40m: on January 19; the longitude 10h:40m: west added on to 18h:40m: makes 29h: and 20m: then take 24h: from the 29h: and you have 5h: and 20m: on January 20.

Fifth. To the apparent astronomical time at Greenwich, correct the sun's declination, taken from first page of the month in the Nautical Almanac, by the hourly difference in adjoining column; multiply the hourly difference by Greenwich time, turning the minutes into tenths of an hour by dividing them by 6, and if any over, annex a cipher, and divide by 6 again for a second decimal. For example: Should the time be 10h:33m: then 6 into 33=5 times and 3 over; to the 3 over annex a cipher, and you have 6 into 30, 5 times, making the time to multiply the hourly difference by 10h:55m.

Ex. Suppose the declination to be..	22° 58′ 57″	Hours difference..	12″ 83
	− 2 15	Time..........	10 55
Correct declination...........	22° 56′ 42″		6415
			6415
			12830
			60)1353565
			2′ 15″

It will be seen by the above example that there are four decimals, viz: Two in the hourly difference, and two in the longitude in time; therefore, cut off four from the right hand of the product, and you have left 135′, and after dividing by 60 there will be a correction of 2′ 15″ to apply to the declination, and as the declination is decreasing subtract the correction, but if the declination is increasing add the correction and you have the correct declination. This rule is to be observed in all cases *except in a meridian altitude.*

Sixth. To the secant (Table 2) of the latitude add the sine (Table 2) of the reduced declination. Their sum less 10 of the index is the log. sine (Table 2) of the true amplitude; to be reckoned from the west when P.M. at ship, and east when A.M.; toward the north when the declination is north, or south when the declination is south.

Seventh. Under the true amplitude place the sun's bearing by compass, and take notice how you put it down, because it is given in points, and you must turn it into degrees, counting from the east or west, toward the north or south. If in the example the bearing is given W. by S. that would be 1 point from west toward the south. Turn 1 point into degrees and it will be W. 11° 15′ S.; or suppose the bearing was given S.S.E., in this case it would be 6 points from east, and turned into degrees would be E. 67° 30′ S. After getting the bearing by compass into proper form, proceed to find the correction of the compass in the following manner.

Eighth. If the true amplitude and sun's bearing from ship are both *north* or both *south*, subtract the less from the greater for the correction of the compass.

Ninth. If the true amplitude and sun's bearing are one *north* and the other *south*, add them for the correction.

Tenth. If the true amplitude is reckoned from the east, and the sun's bearing by compass from the west, or *vice versa*, *add* them together and take the sum from 180°, the remainder will be the correction of the compass.

Eleventh. Name this correction *east*, when the *sun's true amplitude* is on the *right-hand* of the *sun's bearing from ship*, and *west* when it is on the *left-hand*.

Twelfth. The correction of the compass is *deviation* and *variation* combined.

Thirteenth. To find the deviation underneath the correction of the compass, place the *variation* for that locality from the chart. Then if one is east and the other west, add them together, and the sum is the *deviation*; but if they are of like names, that is, both *east* or both *west*, subtract them for the deviation.

Fourteenth. To know if the deviation is east or west, draw the compass and lay off the variation to the *left* of *north* if *westerly*, but to the *right* of *north* if *easterly*; lay off the correction in the same manner; then if the correction is on the *right-hand* of the *variation*, the *deviation* is *easterly*, but if to the *left*, it is *westerly deviation*.

NOTE.—The deviation thus found must only be applied to that point of the compass the ship's head was at when the observation was made. Observe carefully how the examples are worked out, and you will seldom make a mistake.

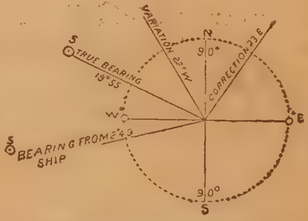
Ex. 1. 1878, April 28th, at 6h:56m: P.M., apparent time at ship in latitude 43° 40′ S., and longitude 6° 30′ E. The sun's bearing setting was W.¼ S. Required the true amplitude, the correction and deviation of the compass. Variation per chart 22° W.

H. M.
Apr. 28, App. T. ship 6 56 P.M.
Longitude 6° 30′ E. −0 26
Green^{h}.time, Apr. 28 6 30

Sun's Dec. Apr. 28, 14°11′56″N.
Cor. for 6h: 30m: . + 5 6
Sun's Cor. declinat'n 14°17′02″N.

Hourly diff. 47″·1
Green^{h}. time 6 ·5
23555
28266
60)30,6,215
5·6

Latitude of ship 43°40′..Sec..10·140640
Sun's Cor. Decl. 14 17 ..Sine. 9·392199
True Ampl. W. 19°57′N. Sine 9·532839
Sun's bearing W. 2 49S. (Setting)
Cor. of Compass 22°46′E.
Var. per Chart 22 00 W.



Deviatiou . . . 44°46′E. *for the point of the compass her head was at when the observation was made.*

Ex. 2. 1878, January 1st, 9h:12m: A.M., apparent time at ship in latitude 62° 10′ S., longitude 138° 00′ W. The sun's bearing rising was S.½W. Required the true amplitude, the correction and deviation of the compass. Variation per chart 45° W.

	H. M.			
Jan. 1, App. T. ship	9 12 A.M.	Sun's Dec. Jan. 1st,	23°00′02″ S.	Hourly diff. 12″·64
A.M. at ship...+	12	Cor. for 6h. 40m... −	1 21	6·4
Dec. 31, Ast. time	21 12	Sun's Cor. Decl...	22°58′41″S.	5056
Longitude 138°00′W.	9 12			7584
Sum..............	30 24			60)8,0,896
Less, 24h........	24			1′·21″
Gr'h time. Jan. 1st,	6 24			

Latitude..................	62° 10′	......Secant	10·330775
Declination...............	22 59	......Sine..	9·591580
Sun's true amplitude E....	56° 45′ S	....Sine..	9·922355
Sun's bearing by Com. W.	84 22 S.		
Sum......................	141° 07′		
From.....................	180 00		
Cor. of the compass.......	38° 53′ W.		
Variation per chart.......	45 00 W.		
Deviation..............	6° 07′ E. *for the point her head was at.*		

Ex. 3. 1878, May 31st, 7h:10m: P.M., apparent time at ship, in latitude 40° 26′ N., longitude 68° 15′ W., the sun's bearing setting was W.¾N. Required the true amplitude, the correction and deviation of the compass. Variation per chart, 8° W.

Ans. True amplitude W. 29° 30′ N.; correction, 21° 04′ E.; deviation, 29° 04′ E.

Ex. 4. 1878, September 5th, 6h:20: A.M., apparent time at ship, in latitude 46° 05′ N., longitude 37° 45′ E., the sun's bearing rising was E.¾S. Required the correction and deviation of the compass. Variation per chart, 4° W.

Ans. 14° 24′ West.

Ex. 5. 1878, September 23d, 5h:43m: A.M., apparent time at ship, in latitude 53° 57′ N., longitude 17° 15′ E., the sun's bearing rising was E. Required the correction and deviation of the compass. Variation per chart, 11° W.

Ans. 11° 0′ E.

Ex. 6. 1878, October 15th, 6h:39m: P.M., apparent time at ship, in latitude 58° 04′ N., longitude 173° 30′ E., the sun's bearing setting was W.¼N. Required the correction and deviation of the compass. Varirtion per chart 10° E.

Ans. True amplitude W. 16° 14′ S.; correction, 19° 03′ W.; deviation, 29° 03′ W.

Ex. 7. 1878, May 29th, 6h:33m: A.M., apparent time at ship, in latitude 0° 0′, longitude 126° 45′ W., the sun's bearing rising E.½S. Required the correction and deviation of the compass. Variation of the chart, 5° E.

Ans. 32° 17′ W.

Ex. 8. 1878, June 21st, 9h:40m: P.M., apparent time at ship, in latitude 62° 29′ N., longitude 60° 45′ W., the sun's bearing setting was N.N.E.½E. Required the correction and deviation of the compass. Variation per chart, 53° W.

Ans. 5° 40′ W.

NOTE.—When the latitude is 0° 0′ 0″ the declination is the sun's true amplitude, reckoned from the east when the observation is made in the morning; west if made in the afternoon; north or south according to the declination. When the sun's declination is 0° 0′ 0″ the sun's true amplitude is east when the observation is made in the morning; west if made in the afternoon.

CORRECTION AND DEVIATION OF THE COMPASS BY AN AZIMUTH.

(Use Table II. for working out Azimuth.)

First. To the mean time at ship add the longitude if west, and subtract it if east, in the same manner as shown in working amplitude, for finding the mean time at Greenwich; *be sure and always date it.*

Second. To the observed altitude apply the index error first (if any); next the dip (Table VII.), *always to be subtracted;* then the refraction (Table VI.), *also subtracted.* Sun's parallax (Table VIII.) that *add always. Sun's semi-diameter* for the day of the month, from the Nautical Almanac, *always to be added to the sun's lower limb, and subtracted from the upper limb*, that will give the sun's true altitude.

Third. Take the sun's declination from page 2d of the month, and correct it by the hourly difference as before shown in amplitude, and find the polar distance as follows: if the declination and the latitude are of the same name, take the declination from 90°; but if of contrary names add the declination to 90°. Then add together the sun's true *altitude*, the *latitude* and the *polar distance*, divide this sum by 2 and call it the half sum, then take the difference between the half sum and the polar distance and call it the remainder.

Fourth. Now add together the
Secant (Table II.) of the true altitude.
Secant (Table II.) of the latitude.
Co-sine (Table II.) of the half sum.
Co-sine (Table II.) of the remainder.
} To the nearest mile only.

Fifth. Half the sum of these four logarithms will give the sine (Table II.) of half the true azimuth, which double and call it north in south latitude, and south in north latitude; east when the time is A.M.; west when the time is P.M.

Sixth. Subtract the true bearing and bearing by compass when they have the same name for the correction.

Seventh. If one bearing is north and the other south, take the true azimuth (that is, the true bearing) from 180°, and change the north or south name *only.* Then the difference is the correction;

except one bearing is east and the other west, when the sum of the two bearings is the correction.

NOTE.—Be careful when taking the true bearing from 180°, you do not change the east or west name, only the north and south.

Eighth. The correction will be *easterly* when the true bearing is on the *right-hand of the bearing by compass; westerly* when on the *left.*

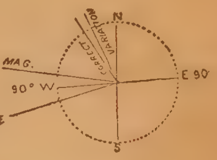
Ninth. If the correction and variation are of the *same name*, subtract them for the deviation. But if they are of different names, add them for the deviation.

Tenth. To know if the deviation is easterly or westerly, draw the compass and lay off the variation to the *left* of *north* if *westerly*, but to the *right* of *north* if *easterly;* lay off the correction in the same manner; then if the correction is on the *right-hand* of the variation, the *deviation* is *easterly*, but if to the *left-hand*, it is *westerly deviation.*

NOTE.—Bear in mind that azimuths reckon from north and south points of the compass, not the same as amplitudes. When the latitude is 0 in an azimuth, assume a name for it, taking care to use the name when naming the true azimuth. Name the true azimuth opposite to the name you have assumed, and proceed without any latitude.

Ex. 1. 1878, June 4th, 6h: 8m: P.M., mean time at ship, in latitude 47° 30′ N., longitude 16° 00′ W. The sun's bearing by compass was W.¼N. Altitude of sun's lower limb 33° 44′ 40″. Index error − 2′ 20″. Eye 19 feet. Required the true azimuth, correction and deviation of the compass. Variation per chart, 4° W.

```
                  H. M.                    °  ′  ″                 °  ′  ″
June 4, M.T.S.    6  8 P.M. Obs. alt. .....33 44 40  Sun's dec. .. 22 27 33N.  Hourly diff..... 17·37
Long'de 16°0′     1  4 W.   Index error.. −  2 20   Correction ..     2·5                 M.T.G..   7·2
                  -----                   --------                --------                        -----
M.T.G. June 4     7 12                    33 42 20  Sun's Red. dec. 22 29 38
                            Dip ......... −  4 11                 90 00 00
                                          --------                --------                   -----------
                                          33 38 09  Polar dist. .. 67 30 22                 60)12,5,064
                            Ref. ........ −  1 24                                              ---------
                                          --------                                                2′5″
                                          33 36 45
                            Palx. ......        7
                                          --------
                                          33 36 52
                            S. Semd.....    15 47
                                          --------
                            True alt..... 33 52 39   Secant . 0·080831
                            Latitude .... 47 30 00   Secant . 0·170317
                            Polar dist. .. 67 30 22
                                          --------
                            Sum.........148 53 01
                            Half-sum..... 74 26 30½ Co-sine. 9·428263
                            Remainder..    6 56  8½ Co-sine. 9·996812
                                          --------           ---------
                                           °  ′
                                          43 32 }          2)19·676223
                                              2 } ...Sine..... 9·838111
                                          --------
Sun's true azimuth S.................     87 04 W.   } Taking the true azimuth from 180°, do not
                                         180 00      }            change the West.
                 Or the                   --------   }
Sun's true bearing N.................     92 56 W.   }
Sun's bearing by compass N. .........     87 11 W.
                                          --------
Correction...........................      5 45 W.  being variation and deviation combined.
Variation per chart..................      4 00 W.
                                          --------
Deviation of the compass.............      1 45 W.  for the point her head was at.
```



Ex. 2. 1878, July 2d, 8h:17m: P.M., mean time at ship in latitude 61° 10′ N., longitude 51° 15′ W. The sun's bearing by compass was N.½E. Altitude of the sun's lower limb 5° 35′ 15″. Eye 19 feet. Required the true azimuth, correction and deviation of the compass. Variation per chart, 56° W.

```
                  H. M.
July 2, M.T.S...  8 17 P.M. | True alt..  5° 37′ 54″  Secant 0·———   Sun's dec. 23° 2′ 54″N.  H. D. 11″·19
Longitude ....    " "  W.   | Latitude..  "  "  "     Secant 0.———             –   2 11            11·7
                  ———       | Polar dist. "  "  "                              ———                ———
M.T.G. July 2, 11 42        |             ————                                 23  0 43 N.        , , , ,
                            | Sum......   "  "  "                              90                 , , , ,
                            | Half-sum.   "  "  "     Co-sine 9·———            ———               , , , ,
                            | Remaind'r 0 05 42       Co-sine 9·———            66 59 17          ———
                                                      ————                                       60)13,0,923
                                                      19·912477                                  ———
                                                      ————                                       2′.11″
                                      64° 43′. Sine... 9·956238
                                            2
                                      ————
                                     ( S. " " W.
Taking from 180° do not change       )   180
  the west name...................   (  ————
                                     ( N. 50 34 W. )
Sun's bearing by compass..........N.  5 37 E.      } Add when one E. and the other W.
                                        ————       )
Correction (being variation and de-
  viation)............................56 11 W.
Variation per chart ..... ...........  56 00 W.
                                        ————
Deviation of the compass ..........    0 11 W. for the point her head was at.
```

Ex. 3. 1878, August 20th, 9h:40m: A.M., mean time at ship in latitude 38° 30 S., longitude 95° 15′ E., the sun's bearing by compass was N.E. by E. Altitude sun's lower limb 25° 30′ 00″. Eye 20 feet. Required the true azimuth, correction and deviation of the compass. Variation per chart, 16° W.

Ans. True azimuth N. 46° 22′ E.; correction, 9° 53′ W.; deviation, 6° 07′ E.

NOTE.—When the correction and variation per chart are contrary names, add them for the deviation.

Ex. 4. 1878, November 11th, 4h:52m: P.M., mean time at ship in latitude 32° 30′ 45″ N., longitude 45° 30′ W., the sun's bearing by compass was W.½N. Altitude sun's lower limb 15° 55′ 30″. Index error + 1′ 40″. Eye 20 feet. Required the true azimuth, correction and deviation of the compass. Variation per chart, 14° W.

Ans. True azimuth S. 56° 12′ W.; correction, 39° 26′ W.; deviation, 25° 26′ W.

Ex. 5. 1878, December 15th, 8h:51m: A.M., mean time at ship in latitude 48° 56′ N., longitude 59° 17′ 30″ W., the sun's bearing by compass was S. Altitude sun's lower limb 12° 16′ 30″. Index error – 3′ 10″. Eye 20 feet. Required the true azimuth, correction and deviation of the compass. Variation per chart, 31° W.

Ans. True azimuth S. 29° 52′ E.; correction 29° 52′ W.; Deviation, 1° 08′ E.

Ex. 6. 1878, June 17th, 3h: 40m: P.M., mean time at ship in latitude 29° 30′ N., longitude 125° 45′ E., the sun's bearing by compass was N. W.½N. Altitude sun's lower limb 11° 30′ 20″. Index error + 1′ 29″. Eye 20 feet. Required the true azimuth, correction and deviation of the compass. Variation per chart, 2° W.

Ans. True azimuth S. 110° 26′ W.; correction, 30° 12′ W.; deviation, 28° 12′ W.

Ex. 7. 1878, December 10th, 9h:10m: A.M., mean time at ship in latitude 60° 10′ N., longitude 169° 10′ 30″ E., the sun's bearing by compass was S.E. by S. Altitude sun's lower limb 4° 20′ 30″. Index error + 1′ 20″. Eye 20 feet. Required the true azimuth, correction and deviation of the compass. Variation per chart, 12° E.

Ans. True azimuth S. 23° 26′ E.; correction, 10° 19′ E.; deviation, 1° 41′ W.

NOTE.—The deviation found is for that point of the compass the ship's head was at when the observation was made.

LATITUDE BY THE MERIDIAN ALTITUDE OF THE SUN.

First. Reduce the ship's longitude into time by multiplying the degrees by 4 and dividing by 60.

Second. In page one of the month, Nautical Almanac (in this book) find the sun's declination for that day, and the hourly difference from the column of difference on the right; multiply this hourly difference by the hours and tenths of an hour of the longitude in time; point off from the right, the number of figures equal to the number of decimals on the hourly difference and longitude in time, the remaining figures will be seconds, which divide by 60 when it exceeds 60, and you have the correction, to be added to the declination when the declination is increasing, but subtracted when decreasing and in west longitude only. When the longitude is east, you must reverse the way of applying the correction; that is, when the declination is increasing subtract the correction, and when decreasing add the correction.

NOTE.—See Table XII. for reducing the sun's declination at any meridian.

Third. To the observed altitude apply the index error of the sextant (if any) according to the sign + add, or – subtract.

Fourth. From Table VII. get the dip for the height of the eye, which is always subtracted.

Fifth. From Table XIII. get the correction for apparent altitude, this, also, always subtracted, (this correction is the refraction and parallax,) or take out the refraction from Table VI. which subtract, and the sun's parallax, Table VIII. which is always to be added.

Sixth. From page two of the month, Nautical Almanac (this book), get the sun's semi-diameter for that day, and add it to the altitude of the sun's lower limb, but subtract it if the upper limb is observed. This is called the true altitude of the sun's centre.

Seventh. Take the true altitude from 90°, which will give the sun's zenith distance, and give it the opposite name to the bearing of the sun; that is, if the sun bears north the zenith distance will be south, and if south call it north.

Eighth. To find the latitude, add the zenith distance and declination together when they are of the same name, but if one is north and the other south, subtract the less from the greater and call the latitude the same name as the greater.

Ex. 1. 1878, August 10th, in longitude 124° 30′ W. the observed meridian altitude of the sun's lower limb was 37° 10′ 30″, bearing north, the index error + 2′ 40″. Height of the eye 20 feet; required the latitude.

Longitude .. 124° 30′ W.
× 4
60)498° 00
Long. in time 8h: 18m:

Sun's dec. Aug. 10 15°32′46″N.
− 6 5
Cor. dec........ 15°26′41″N.

Hourly diff. 43″.95
8.3
13185
35160
60)36,4,785
6′04″785
Cor. 6′5″ for 8h: 18m:
To be subtracted because declination decreasing, and longitude west.

Obs. alt...........................	37° 10′ 30″ N.	
Index error..........................	+ 2 40	
Cor. obs. alt.........................	37 13 10	
Dip Table VII........................	− 4 17	
App. Alt..........................	37 08 53	
Cor. Table XIII..................	− 1 9	
True alt............................	37 07 44	
Sun's semid.........................	+ 15 49	
Sun's true alt......................	37 23 33 90 00 00	
Zenith distance....................	52 36 27 S.	*Subtract when contrary names.*
Sun's cor. dec.......................	15 26 41 N.	
Latitude in..........................	37° 09′ 46″ S.	*Called after the greater.*

Ex. 2. 1878, January 14th, in longitude 51° 00′ W. the observed meridian altitude of the sun's lower limb was 78° 14′ 10″, bearing south, index error − 5′ 50″. Eye 18 feet; required the latitude.

Ans. Sun's cor. dec. 21° 15′ 10″ S.; latitude 9° 35′ 34″ S.

Ex. 3. 1878, September 23d, in longitude 159° 00′ W. the observed meridian altitude of the sun's lower limb was 70° 54′ 20″, bearing north, index error − 3′ 45″. Eye 21 feet; required the latitude.

Ans. Sun's cor. dec. 0° 17′ 35″ S.; latitude 19° 15′ 41″ S.

Ex. 4. 1878, May 20th, in longitude 5° 43′ W. the observed meridian altitude of the sun's upper limb was 54° 23′ 10″, bearing south, index error + 2′ 10″ Eye 20 feet; required the latitude.

Ans. Sun's cor. dec. 20° 01′ 00″ N.; latitude 55° 56′ 23″ N.

Ex. 5. 1878, January 20th, in longitude 5° 20′ W. the observed meridian altitude of the sun's lower limb was 22° 10′ 30″, bearing south; index error − 3′ 10″. Eye 20 feet; required the latitude.

Ans. Sun's cor. dec. 20° 04′ 59″ S.; latitude 47° 37′ 53″ N.

Ex. 6. 1878, March 20th, in longitude 139° 20′ W. the observed meridian altitude of the sun's upper limb was 31° 19′ 40″, bearing south, index error + 4′ 15″. Eye 20 feet; required the latitude.

Ans. Cor. dec. 0° 3′ 38″ N.; latitude 59° 01′ 31″ N.

Ex. 7. 1878, November 16th, in longitude 171° 00′ E., the observed meridian altitude of the sun's lower limb was 71° 43′ 10″, bearing South, index error − 1′ 20″. Height of the eye 24 feet; required the latitude.

Long........	171° 00′ E.	Sun's dec. Nov. 16.	18° 47′ 29″ S.	Hr. dif.....	37″.38
	4		− 7 6		11 . 4
	60)684 00	Cor. Dec..........	18° 40′ 23″ S.		14952
Long. in time	11h: 24m:				3738
					3738
					6.0)42.6.132
					7′ 06.″ 132
					To be subtracted because declination increasing, and longitude East.

Obs. Altitude........	71° 43′ 10″ S.
	− 1 20
	“ “ “
	− 4 4“
	71 37 08
	− 0 16
	“ “ “
	+ 16 13
	“ “ “
	90 00 00
	“ “ “ N.
	“ “ “ S.
Latitude in....	00° 33′ 28″ S.

Ex. 8. 1878, March 31st, in longitude 155° 45′ E., the observed meridian altitude of the sun's lower limb was 68° 55′ 10″, bearing south, index error − 5′ 40″. Eye 19 feet; required the latitude.

Ans. Sun's cor. dec., 4° 3′ 3″ N.; latitude, 25° 02′ 01″ N.

Ex. 9. 1878, September 23rd, in longitude 168° 00′ E., the observed meridian altitude of the sun's upper limb was 56° 12′ 20″, bearing north, index error + 3′ 38″. Eye 20 feet; required the latitude.

Ans. Sun's cor. dec., 0° 3′ 40″ N.; latitude, 34° 01′ 12″ S.

Ex. 10. 1878, March 20th, in longitude 45° 30′ E., the observed meridian altitude of the sun's lower limb was 63° 5′ 10″, bearing north, index error − 4′ 20″. Eye 22 feet; required the latitude.

Ans. Sun's cor. dec., 0° 8′ 30″ S.; latitude, 26° 56′ 30″ S.

Ex. 11. 1878, July 15th, in longitude 151° 22′ E., the observed meridian altitude of the sun's lower limb was 34° 30′ 20″, bearing north, index error + 4′ 30″. Eye 20 feet; required the latitude.

Ans. Sun's cor. dec., 21° 35′ 34″ N.; latitude, 33° 39′ 22″ S.

Ex. 12. 1878. June 10th, in longitude 130° 55′ E., the observed meridian altitude of the sun's upper limb was 55° 25′ 40″, bearing north, index error − 2′ 57″. Eye 20 feet; required the latitude.

Ans. Sun's cor. dec., 23° 0′ 27″ N.; latitude, 11° 57′ 28″ S.

TO FIND THE LATITUDE BY REDUCTION TO THE MERIDIAN.

NOTE.—Tables required: log rising Table XVII; log co-sine Table II; log co-sine Table II; log natural number Table I; log natural sine Table XIV; natural co-sine Table XIV.

First. Correct the watch for what it is slow or fast for apparent time, and then apply the ship's run, viz: The difference of longitude made (in time) to the apparent time. If the time thus made is east, *add*, and if west, *subtract*; *remember going east your time is behind, going west, your time will be too fast for the place you have got to. This will give the hour, angle, or time from noon.* If the observation was made in the afternoon that is P.M.

Second. Find the apparent time at Greenwich by turning the longitude into time by the usual method, viz: Multiplying by 4 and dividing by 6; if the longitude in time is west, add it to the hour angle (or apparent time at ship); and if east, subtract it.

Third. If the time is A.M. add 12 hours to the time shown by watch, and change the date (as per rule) then apply the rate of the watch; if slow, add; if fast, subtract; next the ship's run if east, add; if west, subtract. This will give the apparent time at ship, which is to be subtracted from 24 hours, for the hour angle (or time from noon.)

Fourth. To the apparent time at ship apply the longitude (in time), add if west, subtract if east; should the sum exceed 24 hours subtract 24 hours from the sum, and the remainder will be the Greenwich apparent time of the same name as date at ship.

Fifth. Correct the sun's declination for the Greenwich time (as per rule), from page one of the month, Nautical Almanac, by the hourly difference.

Sixth. Find the sun's true altitude by applying the index error, dip. correction from Table XIII and sun's semi-diameter.

Seventh. Add together the log rising of the hour angle (Table XVII), log co-sine of the latitude, and co-sine of the sun's corrected declination (Table II). The sum of these logs (less tens in their index) will be the log of a natural number (Table I), to be added to the natural sine of the sun's true altitude (Table XIV), which gives the natural co-sine (Table XIV) of the sun's meridian zenith distance, of the opposite name to the bearing of the sun.

Eighth. The zenith distance and the sun's corrected declination will give the latitude. If of the same name add them; if one north and the other south, subtract the less from the greater, and call the latitude after the greater.

Ex. 1. 1878, June 20th, P.M. at ship, in latitude by account 27° 30′ S., longitude 75° 30′ W. The observed altitude of the sun's lower limb north of the observer was 38° 20′ 00″. Eye 16 feet. Time by watch 0h:29m:01s: P.M., which had been found fast for apparent time at ship 1m:12s. The difference of longitude made since to the East was 9 miles; required the latitude by the reduction to the meridian.

	H. M. S.				
June 20th...	0 29 01 P.M.	Sun's dec...23° 27′ 10″ N.	Hr. dif. 1″.13	Obs. alt. ..	38° 20′ 00″
Fast.......	— 1 12	Cr. 5h: 30m.. 6	5.5	Dip.......	— 3 50
	0 27 49	Cor. dec ....23° 27′ 16″ N.	565		38 16 10
Dif. lon. 9′=	0 36 E.		565	Cor.......	— 1 5
		75° 30′ W.			
Hour angle...	0 28 25	4	6.215		38 15 05
Long. 75° 30′	5 02 00 W.			Semid.....	15 46
		60)302 00			
App. Gr'n'h time June 20	5 30 25			True alt...	38° 30′ 51″
		5h: 02m; 00s.			

Time from noon..............	28m: 25s:	......................Log rising................	2.88519
Latitude by account..........	27° 30′ S.	......................Log cosine...............	9.94793
Sun's corrected declination...	23 27 N.	......................Log cosine................	9.96256
Natural number..		625 Log................	2.79568
Sun's true altitude............	38 31	Nat. sine...........	62274
Meridian zenith distance......	51 01 S.	Nat. cosine........	62899
Sun's declination..............	23 27 N.		
Latitude.......................	27° 34′ S.		

Ex. 2. 1878, October 28th, A.M. at ship, in latitude by account 25° 40′ N., longitude 45° 35′ W. The observed altitude of the sun's lower limb south of the observer was 50° 53′ 20″. Eye 20 feet. Time by watch 11h:23m:30s: A.M., which was slow to apparent time at ship 19m:00s., and the difference of longitude made since to the east was 40 miles; required the latitude by the reduction to the meridian.

	H. M. S.				
Oct. 28.......	11 23 30 A.M.	Sun's dec...13° 10′ 44″ S.	Hr. dif. 50″25	Obs. alt...	50° 53′ 20″
	12	Cor.... ... 2 21	Ap. T. G. 2.8	Dip.......	— 4 17
Oct. 27.......	23 23 30	Cor. dec....13° 13′ 05″ S.	40200		50 49 03
Slow	19 00		1005	Cor.......	— 41
Oct. 27.......	23 42 30		60)140.700		50 48 22
Dif. lon......	2 40 E.			Semid	16 9
		H. M. S.	2′.21″		
Ap. time at ship 27th	23 45 10.............	24 00 00		True alt...	51° 04′ 31″
		23 45 10			
Lon. of ship. 3	2 20 W.				
		Hr. angle. 14 50			
G. T. Oct. 27.	26 47 30				
	24				
App. Gr'n'h time Oct. 28	2 47 30				

Time from noon..............	14m: 50s	........................Log rising................	2.32093
Latitude by account..........	25° 40′ N.	........................Cosine....................	9.95488
Sun's declination.............	13 13 S.	............Cosine....................	9.98834
Natural number..		184 Log..................	2.26415
Sun's true altitude............	51° 5	....Nat. Sine.........	77806
Meridian zenith distance......	38° 45′ N.	Nat. Cosine :.....	77990
Sun's declination..............	13 13 S.		
Latitude.......................	25° 32′ N.		

Ex. 3. 1878, January 1st, A.M. at ship in latitude by account 6° 0′ N., longitude 87° 45′ west. The observed altitude of the sun's lower limb was 60° 20′ 10″ south of the observer. Eye 16 feet. Time by watch 11h:38m:20s: A.M., which was slow for apparent time at ship 1m:20s; the difference of longitude made since to the west was 2 miles; required the latitude by reduction to the meridian.

Ans. 6° 3′ N.

Ex. 4. 1878, March 6th, P.M. at ship in latitude by account 42° 2′ S., longitude 166° 0′ west. The observed altitude of the sun's lower limb north of the observer was 52° 48′ 30″. Index error + 1′ 20″. Eye at 20 feet. Time by watch 0h:25m:30s: PM., which was fast for apparent time at ship 1m: 40s. The difference of longitude made since to the east was 38 miles; required the latitude by reduction to the meridian.

Ans. 41° 55′ S.

Ex. 5. 1878, October 20th, A.M. at ship in latitude by account 23° 32′ N., longitude 135° 50′ east. The observed altitude of the sun's lower limb south of the observer was 55° 20′ 10″. Index error + 1′ 10″. Eye 20 feet. Time by watch 0h:20m:00s: which was fast 48m:00s: for apparent time at ship. The difference of longitude made since to the west was 25 miles; required the latitude by the reduction to the meridian.

An. 23° 26′ N.

Ex. 6. 1878, September 24th, A.M. at ship in latitude by account 36° 00′ S., longitude 159° 30′ east. The observed altitude of the sun's lower limb north of the observer was 53° 45′ 35″. Eye at 20 feet. Time by watch 10h:20m:30s: A.M., which had been found to be slow 1h:20:10s: of apparent time at ship. The difference of longitude made to the east was 25 miles after the error on apparent time at ship was determined. Index error – 1′ 20″; required the latitude by the reduction to the meridian.

Ans. 36° 11′ S.

TO FIND THE LATITUDE BY THE MERIDIAN ALTITUDE OF A STAR.

First. Correct the observed altitude for index error (when any).

Second. Dip of the horizon (Table VII).

Third. Correction for apparent altitude (Table XIII).

NOTE.—*Be careful in taking out the correction from this table not to take out the sun's correction, in place of the star's correction.*

Fourth. Take the star's true altitude from 90° for the zenith distance, and call it of *contrary name* to the bearing of the star when observed.

Fifth. To the zenith distance apply the star's declination, found in the (Table of Fixed Stars) pages (242 to 245) of the American Ephemeris and Nautical Almanac for 1878.

NOTE.—*The sign* +* *(placed before the declination) stands for north declination. The sign* —* *stands for south declination.*

Sixth. If the declination and zenith distance are of *same name*, add them for the latitude; when of *contrary names*, subtract them, and call the latitude of the same name as the greater.

Ex. 1. January 1st, 1878, the meridian altitude of the star, a Virginis (*Spica*) was 31° 27′ 40″ bearing south, index error + 5′ 20″. Eye at 20 feet. Required the latitude in.

Observed altitude..........	31° 27′ 40″ S.
Index error..............	+ 5 20
	31 33 00
Dip. Table VII..........	− 4 17
	31 28 43
Correction Table XIII....	− 1 33
Star's true altitude.......	31 27 10
	90 00 00
Zenith distance...........	58 32 50 N.
Star's declination.........	10 31 25+S.
Latitude..................	48° 01′ 25″ N.

Ex. 2. January 1st, 1878, the meridian altitude of the star, *a* Aurigæ (*Capella*) was 87° 30′ 40″ bearing north. Eye 20 feet. Required the latitude in.

Ans. Latitude, 43° 18′ 38″ N.

Ex. 3. January 1st, 1878, the meridian altitude of the star, *a* Geminor (*Castor*) was 70° 50′ 30″ bearing south, index error – 3′ 10″ to subtract. Eye 20 feet. Required the latitude in.

Ans. 51° 26′ 12″ N.

Ex. 4. January 1st, 1878, the meridian altitude of the star, *b* Orionis (*Rigel*) was 50° 31′ 50″ bearing north, index error + 2′ 10″ to add. Eye 18 feet. Required the latitude in.

Ans. 47° 51′ 39″ S.

Ex. 5. January 1st, 1878, the meridian altitude of the star, *b* Geminor (*Pollux*) was 33° 30′ 20″ bearing north. Eye 18 feet. Required the latitude in.

Ans. 28° 16′ 01″ S.

Ex. 6. January 1st, 1878, the meridian altitude of the star, *a* Argus (*Conopus*) was 30° 10′ 15″ bearing south, index error – 3′ 15″ to subtract. Eye 16 feet. Required the latitude in.

Ans. 7° 20′ 42″ N.

Ex. 7. January 1st, 1878, the meridian altitude of the star, *a* Aquilæ (*Altair*) was 67° 42′ 30″ bearing south, index error – 3′ 40″ to subtract. Eye at 20 feet. Required the latitude in.

Ans. 30° 58′ 42″ N.

TO FIND THE LONGITUDE BY CHRONOMETER.

Rules for finding the Accumulated Rate, and whether the Chronometer is Losing or Gaining, etc.

First. Take the given time by the chronometer, and apply the error given on the last date.

Second. If fast the error is to be subtracted, if slow the error is to be added; then you have the chronometer regulated up to the time the last error was given.

Third. Get the difference between the two errors and their dates; when both errors are slow or both fast, subtract; one slow and the other fast add them together, then bring this difference into seconds (if in minutes and seconds) by multiplying by 60, then the difference in seconds between the two errors is to be divided by the number of days between the given errors, and to what remains annex a cipher, and divide again for the tenths or decimal part of the daily rate.

Fourth. Next, the number of days from the date of the last error and date of the chronometer is to be multiplied by the daily rate, (taking in the hours of the chronometer time as a decimal of a day by annexing a cipher to the hours, and dividing by 24), after cutting off the decimals, you have the accumulated rate from the last error given to the time shown by chronometer, which is to be added to the chronometer time when *losing* and subtracted when *gaining*.

Fifth. *To know when gaining or losing, use the following rules:*

LOSING.	When the chronometer is slow at 1st date, and at 2d date still slower. When the chronometer is fast at 1st date, and at 2d date not so fast. When the chronometer is fast at 1st date, and at 2d date is slow.
GAINING.	When the chronometer is fast at 1st date, and at 2d date still faster. When the chronometer is slow at 1st date, and at 2d date not so slow. When the chronometer is slow at 1st date, and at 2d date is fast.

Ex. 1. Suppose the first date to be July 1st, and the second date September 20th. Interval or elapsed time 81 days.

	H.	M.	S.	
July 1st, slow.....	1	03	20	
Sept. 20th, slow...	1	5	13.4	Slow and more slow, losing.
Difference lost.....		1	53.4	
		60		

Days elapsed......81)113.4(1s.4 daily rate losing.
81

32.4
32.4

Ex. 2.

	H.	M.	S.
January 28th......	3	27	18
January 1st, slow..	1	25	55
M. T. G., Jan. 1st.	4	53	13
Gain in 27d:5h.... –		1	35.2
M. T. G., Jan. 28th	4	51	37.8

	H.	M.	S.	
Slow, January 1st.........	1	25	55	Gaining.
Slow, January 11th...... .	1	25	20	

As 10 days is to...............=35:27.2

Days from Jan. 1 to Jan. 28th. 27.2

70

245

70

1.0)95.2.0

6.0)9.5.2

Gain in 27.2 days......... 1.35.2

Ex. 3.

	M.	S.	
July 1st, fast........	0	10.4	*Fast and then slow, losing.
Sept. 20th, slow....	1	43	
Difference lost.. .	1	53.4=1s.4 *losing daily.*	

* Fast and slow, the *sum* is the *difference.*

Ex. 4.

	M.	S.	
July 1st, fast........	3	20	Fast and more fast, *gaining.*
Sept. 20th, fast......	5	13.4	
Difference gained.	1	53.4=1s.4 *gaining daily*	

Ex. 5.

	M.	S.	
July 1st, slow.......	5	13.5	Slow and less slow, *gaining.*
Sept. 20th, slow....	3	20	
Difference gained.	1	53.4=1s.4 *gaining daily.*	

Ex. 6.

	M.	S.	
July 1st, slow......	1	43	*Slow and fast, *gaining.*
Sept. 20th, fast.....	0	10.4	
Difference gained.	1	53.4=1s.4 *gaining daily.*	

* Slow and fast, the *sum* is the *difference.*

RULES FOR FINDING THE LONGITUDE.

First. After finding the *mean time* at Greenwich take out the declination from page two of the month, Nautical Almanac (this book) (or from the American Almanac, 1878) and correct it by the hourly difference found on page one of the month; multiply this hourly difference by the mean time at Greenwich, after dividing the minutes by 6, same as in azimuth; this will give the correction to be added to the declination when increasing, and subtract when decreasing. If correcting back from the following day, which may be done (when the hours of Greenwich time exceed 15); then by taking the mean time at Greenwich from 24 hours, you can get the next day's declination, and correct it back for what it wants (in time) of being noon of the next day, in which case you must subtract the correction when increasing, and add it when decreasing; this method has to be done on account of the difference for an hour in the Almanac being different in quantity

Second. Take out the equation of time from page *two* in the Almanac also, and correct it in the same manner as the declination; but when applying it to the apparent time at ship, always go by the rule at top of page *one* of the month in the Nautical Almanac.

Third. If the *declination* and *latitude* are both *north* or both *south*, the *declination* is to be taken from 90° for the *polar distance*; but if one is *north* and the other *south*, the declination *must* be added to 90° for the polar distance.

Fourth. Correct the sun's altitude in the same way as for the meridian altitude, first for index error (if any,) next the dip of the horizon,(Table VII,) then the correction from (Table XIII), and sun's semi-diameter from the Nautical Almanac.

Fifth. Add together the true *altitude*, the *latitude*, and *polar distance*, divide this sum by 2, and call it the *half sum*, then take the true *altitude* from this half sum and call it the remainder.

Note.—If the polar distance exceeds 90°, take the secant of the corrected declination, in place of the co-secant of the polar distance.

Sixth.
Add together. { Secant of the latitude.
Co-secant of the polar distance.
Co-sine of the half sum.
Sine of the remainder. } To seconds.

Seventh. The sum of these four logs, rejecting 10 in their index, being added together will give the *apparent time* at ship in (Table XVIII), when a P.M. sight, and of the same date as the question; but if the sight be A.M., the time thus found is to be taken from 24 hours for the apparent time at ship, which date one day back of the date at the head of the question.

Eighth. To the *apparent time* at ship apply the *equation* of *time* (according to the rule found at the top of page one, Nautical Almanac), and this will give the *mean time* at *ship*.

Ninth. If the *mean time* at Greenwich is of the same date as *mean time* at ship, subtract the *less* from the *greater*, and that will be the longitude in time; but should either of the *two times* be of different dates, add 24 hours to whichever is the greatest date before subtracting, then turn the time into *degrees* by Table XI, and name the longitude east, if Greenwich time is *least;* and west, if Greenwich time is *best.*

Tenth. Should the longitude in time exceed 12 hours, take it from 24 hours, before turning it into degrees; *do not forget to change its name.*

Ex. 1.

	H.	M.	S.
Mean time at ship, March 5th........	20	14	36
Mean time at Greenwich, March 5th.	7	13	36
	13	01	00
	24	00	00
Longitude in time..................	10	59	00=164° 45′ 00″ W.

Eleventh. To find the logs. for seconds, take the difference between the logs. for the given minutes, and the next higher number of minutes; multiply this difference by given number of seconds, and divide by 60; add the quotient to the log. found for degrees and minutes, in the case of sine and secant; subtract it in the case of co-sine and co-secant. (See explanation of Table II.)

Twelfth. *To reduce the latitude to the time of observation.* Remember the latitude must always be reduced to the time of observation, and the usual method of doing this at sea, is to find the difference of latitude the ship has made in the interval between the time the sights were taken and the correct latitude obtained by observation at noon. With the course and distance sailed from time of sights enter (Table III) and find the difference of latitude in the latitude column, this difference is to be applied according to the course the ship has been steering; viz: When the sights are taken in the afternoon, and in north latitude, and sailing north, *add* the difference of latitude; when sailing south, *subtract* the difference of latitude. Thus you will have the correct latitude of the ship at the time of sights. To apply this rule in south latitude simply substitute south for north.

Thirteenth. *To reduce the longitude by chronometer at time of sights to noon.* Take the latitude in as a course, and the departure made in the interval, in the latitude column, the difference of longitude is found in the distance column. Apply this as follows:

Observation taken in the morning, in west longitude.	Sailing west, add. Sailing east, subtract.
Observation taken in the afternoon, in west longitude.	Sailing west, subtract. Sailing east, add.

To or from the longitude by chronometer, will give the longitude in at noon. *By substituting east for west, the same rule may be applied in east longitude.*

Fourteenth. When the latitude and declination is 0° 0′ 0″ take the true altitude from 90°, and the zenith distance turned into time is the apparent time at ship if P.M., or taken from 24 hours for the apparent time if A.M. sights.

Ex. 1. 1878, January 28th, P.M., at ship in latitude 32° 44′ 34″ N. The observed altitude of the sun's lower limb was 22° 3′ 20″; index error +1′ 02″. Eye 20 feet. Time by chronometer, 28d: 3h: 27m: 18s., which was slow for mean noon at Greenwich, 1h: 25m: 55s., January 1st.; and on January 11th was slow for mean noon at Greenwich 1h: 25m: 20s. Required the longitude by chronometer.

	H. M. S.
January 28th....	3 27 18
Slow Jan. 11th...	1 25 20
	4 52 38
Gain in 17.2 days.	— 1 00
M. T. G., Jan. 28.	4 51 38

	H. M. S.
Slow Jan. 1st....	1 25 55
Slow Jan. 11th..	1 25 20
Gain 10 days.....	= 35
Gain 1 day.......	= 3.5
Jan. 11th to 28th.	=17.2
	7.0
	245
	35
	6.0) 6.0.20
Accumulated rate.	1.0.2

Sun's dec ..	18° 9′ 9″ S.
Cor. for 4h:52m.	— 3 13
Cor. dec.....	18 5 56 S.
	90 0 0
Pol. dis......	108° 5′ 56″

H. dif. 39″.75
4.86
23850
31800
15900
6.0) 193″.1850
3.13

Observed altitude.	22°	3′ 20″
Index error......	+	1 02
	22	4 22
Dip. for 20 feet...	−	4 17
	22	0 05
Correction (table 13)	−	2 12
	21	57 53
Sun's semidiameter	+	16 16
True altitude	22	14 09
Latitude.........	32	44 34
Polar distance....	108	05 56
Sum...	163	04 39
½ Sum..........	81	32 19
Remainder.......	59	18 10

	M. S.
Equation of time...	13 14.02
Cor. for 4h:52m....	+ 2.25
Cor. equat'n of time.	13 16.27

Secant =	0.075149
Co-sec. =	0.022038
Co-sine =	9.167739
Sine... =	9.934436
	9.199362

075103
+ 46
075149

021999
+ 39
022038

168008
− 269
167739

934424
+ 12
934436

	H. M. S.
App. time at ship January 28th.	3 7 32
Equation of time.	+ 13 16
Mean time at ship January 28th.	3 20 48
Mean time at Green'h Jan. 28.	4 51 38
Longitude.........	1 30 50=22° 42′ 30″ W.

N. B.—Mean time at ship less than mean time at Greenwich, therefore longitude is west.

Hr. dif....... 464
4.86
2784
3712
1856
Cor....... 2″.25504

Dif............ 65
Seconds....... 34
324
243
6.0) 275.4
Cor.......... 45.54

Dif............ 42
Seconds....... 56
252
210
6.0) 235.2
Cor.......... 39.12

Dif............ 849
Seconds....... 19
764
8491
6.0) 1613 1
Cor......... 268.51

Dif............ 75
Seconds....... 10
6.0) 75.0
Cor........... 12.30

NOTE.—When P.M. the sum of the four logarithms gives (in Table 18) the Apparent Time at ship of the same date.

Ex. 2. 1878, April 1st, A.M., at ship, in latitude 32° 16′ 32″ S. The observed altitude of the sun's lower limb was 32° 16′ 20″; index error+1′ 35″. Eye 18 feet. Time by chronometer, March 31st, 8h:30:32s., which was slow for mean noon at Greenwich 1h:24m:12s., January 14th; and on February 13th, was slow 1h:20m:27s. for mean noon at Greenwich. Required the longitude by chronometer.

H. M. S.
March 31st, chronometer 8 30 32
Slow.................... 1 20 27
“ “ “
Gain in 46.4 days × 7.5 s. – 5 48
M. T. G., March 31st... 9 45 11

Declination. 4° 13′ 03″ N.
Correction.. + 9 26
“ “ “ N.
90
Sun's P. D. 94 22 29

Hr. dif.... 58″.03
9h:45m.=9.75
“ “ “
“ “ “
“ “ “
6.0)56.5.7925
9.26

H. M. S.
Jan. 14th, slow.. 1 24 12
Feb. 13th, slow.. 1 20 27
Chr. gained in 30 dys 3.45
60

Divide by days, 30)225(7.5 gaining daily.
210
150

M. S.
Eq. of time.... 4 14.00
Cor. for 9h:45m – 7.38
Cor. eq. time... 4 6.62

Hr. dif.... 0″.757
9h:45m=9.75
, , , , ,
, , , , ,
, , , , ,
7.38075

Obs. altitude.......... 32° 16′ 20″
+ “ “
“ “ “
– “ “
“ “ “
– “ “
“ “ “
+ “ “
32 28 31
“ “ “
“ “ “
“ “ “
“ “ “
47 05 15

Secant 0. ......
Co-Sec. 0. ......
Co-sine. 9. ......
Sine.. . 0. ......
Logarithms to Seconds.
Log.... 9.196961

H. M. S.
3 6 59
24
A. T. ship, March 31st. 20 53 01
+ “ “
“ “ “
“ “ “
Longitude............ 11 11 57=167° 59′ 15″ E. *because Greenwich time is least.*

Note.—When A.M. sights, take the time (the four logarithms gives) from 24 hours for the apparent time at ship, and date it one day less than the date at head of question.

Ex. 3. 1878, December 10th, P.M., at ship in latitude 40°20′ S. The observed altitude of the sun's upper limb was 28° 45′ 20″; index error, + 2′ 10″. Eye 20 feet. Time by the chronometer, December 9th, 19h:52m:31s: which was fast for mean noon at Greenwich 23m:00s: September 30th, and October 20th was fast for mean noon at Greenwich 25m:30s: Required the longitude by chronometer.

	H. M. S.		° ′ ″		
Dec. 9th, time by chron...	19 52 31	Sun's dec.	22 56 43S.	Hourly diff.	13″.32
	— 25 30		— 1 02	Cor.for4h:39m:	4.65
	" " "		" " "		,,,,
50.8 days × 7.5s. per day =	— 6 21		90		,,,,
					,,,,
Mean time at Green. Dec.9,	19 20 40	Pol. dist.	" " "		60)6,1,9380
					1 .02

	° ′ ″		M. S.		
Obs. alt. sun's upper limb..	28 45 20	Equat'n of time	6 59.31	Hourly diff......	1″.139
	+ " "	Correction.....	+		4.65
	" " "		7. 04.60		
	— " "				
	" " "				
	— " "				
	" " "				
	— " "				
	28 25 20				
	40 20 00	Secant........	0.——		
	67 04 19	Co-secant.....	0.——	*Logarithms to Seconds.*	
	" " "				
	" " "	Co-sine.......	9.——		
	39 29 29	Sine..........	9.——		
	H. M. S.				
A.T.S. Dec. 10th	4 45 38	Logarithm....	9.532246		
	*24				
A.T.S. Dec. 9th.	28 45 38	*because the mean time at Greenwich is the 9th.*			
	— 7 05				
M.T.S. Dec. 9th.	" " "				
M.T.G. Dec. 9th.	" " "				
Longitude..	9 17 53	=139° 28′ 15″ E.			

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* When the ship's date is one day more than the Greenwich date, you will add 24 hours to the hour angle, and call that the apparent time at ship on the day before; next apply the equation of time, and you will have the mean time at ship and mean time at Greenwich reckoned from the same noon.

Ex 4. 1878, April 20th, A.M., at ship in latitude 46° 15′ N. The observed altitude of the sun's lower limb was 29° 8′ 20″; index error – 1′ 22″. Eye 20 feet. Time by chronometer, April 20th, 0h:50m:55s: which was fast for mean noon at Greenwich 50m:25s: February 21st and on March 3d was 50m:00s: fast for mean noon at Greenwich. Required the longitude by chronometer.

```
                                  H. M. S.   |                  °  ′  ″
April 20th, time by chron..  0 50 55  | Sun's dec..11 34 14 N.  Hrly. diff.  51″.31
                                   — 50 00  | Cor. for 3m:    +   3                      0.05
                                  ———————  |                 ————————                ——————
                                   "  "  "  |                 11 34 17 N.  Correction 2,5655
48 days × 2.5s. per day  =  +  2  0  |                 90                          ══════
                                  ———————  |                 ————————
Mean time at Green. Apr.20,  0  2 55  | Polar Dist.     78 25 43
                                  ═══════                    ════════

Obs. alt, sun's }  °  ′  ″                         M.  S.
  lower limb..  }  29  8 20  Equation of time    1 8.47  Hourly difference   .539
                   —  1 22  Correction .....   +  .02                          .05
                  —————————                     ———————                     ——————
                   "  "  " )Redcd. eq. time  –1 8.49  Correction ...... ,02695
                   —  "  " |                   ═══════
                  ————————— |
                   "  "  " |
                   —  "  " |
                  ————————— |
                   "  "  " |
                   +  "  " )
                  —————————
                  29 17 03
                  46 15 00 — 0.———— )
                  78 25 43 — 0.———— |
                  —————————           |
                   "  "  "            } Logarithms to Seconds.
                   "  "  " — 9.———— |
                  47 41 50 — 9.———— )
                   H.  M.  S.          ————
                   3 57 50 = 9.390813
                  24                  ════════
                  —————————
A.T.S. Apr.19th,  20 02 10
                   —  1  8
                  —————————  ( When the mean time at ship and mean time at Green-
                   "  "  "   {   wich are different dates, add 24 hours to the greater
M.T.G. Apr.19th   24  2 55  (   date before getting their difference for the longitude.
                  —————————
Longitude.....4h:1m:53s:=60° 28′ 15″ W.
              ═══════════  ═══════════════
```

Ex. 5. 1878, September 22d, P.M., at ship in latitude 12° 18′ S. The observed altitude of the sun's lower limb was 35° 38′ 50″; index error+2′ 10″. Eye at 20 feet. Time by chronometer, Sept. 21st, 17h:28m:30s., which was slow for mean noon at Greenwhich, 1h:12m:56s. June 27th, and on July 7th was slow 1h:14m:20s. for mean noon at Greenwich. Required the longitude by chronometer.

Ans.	Accumulated rate for 76.8 days......	+ 10m:45s.
	Mean time at Greenwich, September 21st........	18h:53m:35s.
	Polar distance......................	90° 21′ 01″
	Sum of four logarithms..........................	9.300063
	Mean time at ship, September 21st................	27h:25m:01s.
	Longitude..	127° 51′ 30″ E

Ex. 6. 1878, May 20th, A.M., at ship in latitude 56° 50 N. The observed altitude of the sun's upper limb was 30° 12′ 30″; index error+2′ 40″. Eye at 20 feet. Time by chronometer, May 19th, 22h:17m:20s., which was slow for mean noon at Greenwich, 1h:21m:14s. February 18th, and on March 10th was slow 1h:20m:18s., for mean noon at Greenwich. Required the longitude by chronometer.

Ans.	Mean time at Greenwich, May 19th	23h:34m:19s.
	Polar distance	69° 59′ 23″
	Sum of four logarithms	9.468138
	Mean time at ship, May 19th	19h:33m:41s.
	Longitude	60° 9′ 30″ W.

Ex. 7. 1878, November 18th, A.M., at ship in latitude 46° 10′ S. The observed altitude of the sun's lower limb was 39° 7′ 40″; index error+2′ 10″. Eye 19 feet. Time by chronometer, November 17th, 13h:5m:10s., which was fast for mean noon at Greenwich, 16m:35s. September 4th, and on September 14th was fast 15m:10s. for mean noon at Greenwich. Required the longitude by chronometer.

Ans.	Mean time at Greenwich, November 17th	12h:59m:9s.
	Sum of four logarithms	9.293290
	Mean time at ship, November 17th	20h:14m:44s.
	Longitude	108° 53′ 45″ E.

Ex. 8. 1878, April 1st, A.M., at ship in latitude 33° 58′ 44″ S. The observed altitude of the sun's lower limb was 33° 14′ 50″; index error − 1′ 30″. Eye 21 feet. Time by chronometer, March 31st, 7h:56m:20s. which was slow for mean noon at Greenwich, 1h:15m:07s. December 11th, 1877, and on January 10th was slow 1h:12m:40s. for mean noon at Greenwich. Required the longitude by chronometer.

Ans.	Mean time at Greenwich, March 31st	9h:2m:26s.
	Sum of four logarithms	9.150628
	Mean time at ship, March 31st	21h:7m:22s.
	Longitude	178° 46′ 0″ W.

EXAMINATION PAPERS.

The following six papers contain each, nine problems, and as the learner is supposed to have mastered in the foregoing pages all the rules necessary for their solution, it is now desirable that he work out successively the problems in these papers (calculating to within a few seconds), as they will be needed in his examination for master or mate.

Ex. 1. No. 1.

HOURS.	COURSES.	KNOTS.	10THS.	WINDS.	LEEWAY.	DEVIAT'N.	REMARKS, ETC.
1	S. by W.	4	5	West.	1	8° E.	A point.
2	"	5	5	"			In latitude.........10° 1′ N.
3	"	5	5	"			In longitude........9° 40′ W.
4	"	5	5	"			Bearing by Comp., N. by W.
5	S. by E.¾E.	3	5	S.W. by W.	1¼	14°15′W	Head at N.N.W. Dev.8°40′W
6	"	3	5	"			Distance 20 miles.
7	"	3	5	"			Variation, 6° E.
8	"	2	5	"			
9	E.½S.	4	5	N. by E.½E.	¾	17° 8′W.	
10	"	4	5	"			
11	"	5	5	"			
12	"	5	5	"			
1	S.E.¼S.	5	5	N.E.	1½	22°41′W	
2	"	5	5	"			
3	"	5	5	"			
4	"	6	5	"			
5	S.¼E.	3	5	E.½S.	1¼	3° 15′W.	
6	"	3	5	"			
7	"	4	5	"			
8	"	4	5	"			A current set by compass S. 25° W. (correct magnetic) 18 miles from the time the departure was taken to the end of the day.
9	S.S.E.¼E.	2	5	E.¼N.	¾	9° W.	
10	"	3	5	"			
11	"	4	5	"			
12	"	4	5	"			

Ans.
Bearing corrected.......................S. 14° E.
Current " ....S. 31 W.
1st course " ....S. 14 W.—Distance 21 miles
2d " " ....S. 42 E. " 13 "
3d " " ....S. 87 E. " 20 "
4th " " ....S. 42 E. " 23 "
5th " " ....S. 14 W. " 16 "
6th " " ....S. 20 E. " 15 "
Difference of latitude.. 112.6 Departure 35.7
True course.......... S. 17° E. Distance............ 118 miles
Latitude in .... 8° 8′ N. Longitude in........ 9° 04′ W.

Ex. 2. 1878, March 20th, in longitude 148° 45′ W. The observed meridian altitude of the sun's upper limb was 45° 35′ 00″ bearing S.; index error − 7′ 56″. Height of eye 22 feet. Required the latitude.

Ans.
Sun's corrected declination .... 0° 4′ 16″ N.
Latitude .... 44° 58′ 37″ N.

Ex. 3. In latitude 36° 17′, the departure made good was 187 miles. Required the difference of longitude by parallel sailing.

Ans. Difference of longitude 232.0

Ex. 4. Required the course and distance from A to B by calculation on Mercator's principle.

Ans.
Latitude of A .... 51° 25′ N. Longitude .... 9° 29′ W.
Latitude of B .... 49° 40′ N. Longitude .... 53° 54′ W.
Difference of latitude.. 105
Meridian difference latitude 166
Difference of longitude 2665
Course .... S. 86° 26′ W. Distance .... 1687 miles

Ex. 5. 1878. June 19th, 6h:30m: P.M. apparent time at ship in latitude 69° 10′ N., longitude 180° 00′ E. The sun's magnetic amplitude was N.W. by W.¾W. Required true amplitude and error of the compass, and supposing the variation to be 15° E., required the deviation of the compass for that position of the ship's head.

Ans.	Sun's corrected declination	23° 1′ 02″ N.
	True amplitude	W. 51° 49′ N.
	Compass correction	26° 30′ E.
	Deviation of the compass	11° 30′ E.

Ex. 6. 1878. April 1st, A.M. at ship in latitude 33° 18′ 15″ S., the observed altitude of the sun's lower limb was 33° 14′ 50″, index error – 1′ 10″. Eye at 20 feet. Time by chronometer March 31st, 8h:30m:32s: which was slow for mean noon at Greenwich 1h:14m:13s: January 29th, and on February 13th was slow for mean noon at Greenwich 1h:12m:25s: Required the longitude by chronometer.

Ans.	Mean time at Greenwich March 31st	9h:37m:23:
	Polar distance	94° 22′ 21″
	Sum of four logarithms	9.160121
	Mean time at ship March 31st	21h:5m:20s:
	Longitude	171° 59′ 50″ E.

Ex. 7. 1878, November 8th, 2h:4m: P.M. mean time at ship in latitude 57° 25′ 40″ N., longitude 133° 18′ W., the sun's magnetic azimuth was S.W.¼S. Observed altitude of the sun's lower limb 10° 26′ 15″. Eye at 20 feet. Index error + 2′ 50″. Required the true azimuth, correction and deviation of the compass. Variation per chart 5° W.

Ans.	Mean time at Greenwich November 8th	10h:57m:12s:
	Polar distance	106° 45′ 54″
	Sum of four logarithms	18.907871
	True azimuth	S. 33° 02′ W.
	Compass correction	9° 9′ W.
	Deviation of the compass	4° 09′ W.

Ex. 8. 1878, June 15th, P.M. apparent time at ship, latitude by account 59° 10′ N., longitude 20° 00′ W., the observed altitude of the sun's lower limb bearing S. was 53° 45′ 45″. Eye at 20 feet. Index error – 0′ 00″. Time by watch 0h:15m:26s P.M., which was found to be slow 4m:12s for apparent time at ship. The difference of longitude made to the east was 13 miles. Required the latitude by reduction to the meridian.

Ans.	Hour angle	20m:30s:
	Sun's corrected declination	23° 19′ 55″ N.
	Sun's true altitude	53° 56′ 38″
	Latitude	59° 12′ 0″ N.

Ex. 9. 1878. The observed meridian altitude of the star A. Geminor was 70° 50′ 30″, bearing S. Index error – 3′ 10″. Eye 20 feet. Required the latitude.

Ans.	Star's declination	32° 09′ 17″ N.
	Latitude	51° 26′ 32″ N.

Ex. 1. No. 2.

Hours.	Courses.	Knots.	10ths.	Winds.	Leeway.	Deviat'n	Remarks, Etc,
1	N.E.½N.	3	5	E.S.E.	¾	8° E.	A point.
2	"	3	5	"			In latitude... ....10° 20′ N.
3	"	4	5	"			In longitude ......20° 30′ W.
4	"	4	5	"			Bearing by Comp. W. by S.¾S.
5	E.¾S.	4	5	N.N.W.	½	25° E.	Head N.¾E. Deviat'n 3¼° W.
6	"	4	5	"			Distance 25 miles.
7	"	4	5	"			Variation 3° E.
8	"	4	5	"			
9	E. by S.	4	5	S.¼W.	1	22° E.	
10	"	4	5	"			
11	"	4	5	"			
12	"	4	5	"			
1	N.W.½W.	3	5	S.W.½W.	1½	28¼°W.	
2	"	3	5	"			
3	"	3	5	"			
4	"	3	5	"			
5	South.	3	5	E.½S.	1¼	0°	
6	"	4	5	"			
7	"	4	5	"			
8	"	4	5	"			A current set by compass south (correct magnetic) 10 miles from the time the departure was taken to the end of the day.
9	N.¾E.	4	5	E.¼N.	1	3¼° W.	
10	"	4	5	"			
11	"	4	5	"			
12	"	4	5	"			

Ans.
Bearing corrected........................N. 70° E.
Current " ....S. 3 W.
1st course " ....N. 42 E. – Distance 16 miles.
2nd " " ....S. 48 E. " 18 "
3rd " " ....S. 65 E. " 18 "
4th " " ....N. 59 W. " 14 "
5th " " ....S. 17 W. " 17 "
6th " " ....N. 3 W. " 18 "
Difference of latitude.. 0′.2 Departure............. 45′.5
True courses.......... S. 89° E. Distance.... ....46 miles.
Latitude in...........10° 20′ N. Longitude in..... ....19° 44′ W.

Ex. 2. 1878, March 30th, in longitude 155° 45′ E., the observed meridian altitude of the sun's upper limb was 69° 27′ 00″, bearing south. Index error – 5′ 24″. Height of the eye 19 feet. Required the latitude.

Ans.
Sun's corrected declination............................ 3° 39′ 47″ N.
Latitude.................................... .... 24° 38′ 43″ N.

Ex. 3. In latitude 53° 52′ the departure made good was 6′.75 miles. Required the difference of longitude by parallel sailing.

Ans. Difference of longitude...................................... 11′.44

Ex. 4. Required the course and distance from A. to B., by calculation on Mercator's principle.

Ans.
Latitude of A....... 12° 46′ N. Longitude .... 45° 10′ E.
Latitude of B....... 18° 34′ N. Longitude .... 72° 53′ E.
Difference of latitude.. 348
Meridian difference latitude........................... 362
Difference of longitude................. 1663
Course.......... N. 77° 43′ E. Distance .... 1636 miles.

Ex. 5. 1878, May 29th, 6h:30m: A.M., apparent time at ship, in latitude 29° 46′ N., longitude 0° 15′ 40″ E. The sun's magnetic amplitude was E.¾S. Required the true amplitude, and error of the compass, and supposing the variation to be 19° W., required the deviation of the compass for that position of the ship's head.

Ans.	Sun's corrected declination	21° 36′ 45″ N.
	True amplitude	E. 25° 7′ N.
	Compass correction	33° 33′ W.
	Deviation of the compass	14° 33′ W.

Ex. 6. 1878, August 25th, A.M., at ship in latitude 9° 50′ 15″ S., the observed altitude of the sun's lower limb was 32° 15′ 20″, index error+3′ 40″. Eye at 20 feet. Time by chronometer, 24d: 18h: 58m: 20s., which was slow for mean noon at Greenwich 2h: 7m: 33s. May 11th, and on June 10th was slow for mean noon at Greenwich 2h: 5m: 48s. Required the longitude by chronometer.

Ans.	Mean time at Greenwich, August 24th	20h: 59m: 43s.
	Polar distance	100° 46′ 30″
	Sum of four logarithms	9.313965
	Mean time at ship, August 24th	20h: 26m: 01s.
	Longitude	8° 25′ 30″ W.

Ex. 7. 1878, April 15th, 7h: 21m: A.M., mean time at ship, in latitude 24° 44′ N., longitude 91° 00′ W., the sun's magnetic azimuth was E.¾N., observed altitude of the sun's lower limb was 22° 10′ 40″. Eye at 20 feet. Index error—0′ 00″. Required the true azimuth, correction, and deviation of the compass. Variation per chart, 9° east.

Ans.	Mean time at Greenwich, April 15th	1h: 25m.
	Polar distance	80° 09′ 24″
	Sum of four logarithms	19.705025
	True azimuth	S. 90° 48′ E.
	Compass correction	7° 38′ E.
	Deviation of the compass	1° 22′ W.

Ex. 8. 1878, January 1st, A.M., apparent time at ship, latitude by account 6° 10′ N., longitude 87° 45′ W., the observed altitude of the sun's lower limb bearing south was 60° 20′ 10″. Eye at 16 feet. Index error—0′ 00″. Time by watch, 11h: 38m: 20s: A.M., which was found to be slow 1m: 20s. for apparent time at ship. The difference of longitude made since to the west was 2 miles. Required the latitude by reduction to the meridian.

Ans.	Hour angle	20m: 28s.
	Sun's corrected declination	22° 58′ 53″ S.
	Sun's true altitude	60° 32′ 10″
	Latitude	6° 3′ 0″ N.

Ex. 9. 1878, the observed meridian altitude of the star B. Geminor was 33° 30′ 20″, bearing north. Index error+0′ 0″. Eye at 18 feet. Required the latitude.

Ans.	Star's declination	28° 19′ 10″ N.
	Latitude	28° 16′ 10″ S.

Ex. 1. No. 3.

HOURS.	COURSES.	KNOTS.	10THS.	WINDS.	LEEWAY.	DEVIAT'N.	REMARKS, ETC.
1	W.S.W.	6		N.W. by N.	¾	17° W.	A point. In latitude.........48° 25′ N. In longitude ......57° 19′ W. Bearing by Comp., W.¾N. Head N.W. Dev .5½° E. Distance 19 miles. Variation, 20° W.
2	"	6		"			
3	"	6		"			
4	"	6		"			
5	E.¼N.	8	9	N.¾E.	1	17½°E.	
6	"	9	7	"			
7	"	9	7	"			
8	"	9	7	"			
9	E.S.E.¼S.	9	9	S. by W.½W.	1	14° E.	
10	"	9	7	"			
11	"	9	7	"			
12	"	9	7	"			
1	N.E.	10	8	N.W. by N.	1¼	17° E.	
2	"	10	8	"			
3	"	10	7	"			
4	"	10	7	"			
5	N.E.½E.	7	5	N.E. by E.	¾	20° E.	
6	"	7	5	"			
7	"	7		"			A current set by compass N. 22° W. (corr't magnetic) 26 miles from the time the departure was taken to the end of the day.
8	"	7		"			
9	W.¼S.	6		S.¾W.	½	14°W.	
10	"	4		"			
11	"	3		"			
12	"	3		"			

Ans.
Bearing corrected..............................N. 84° E.
Current " ....N. 42 W.
1st course " ....S. 22 W—Distance 24 miles
2d " " .... S. 84 E. " 38 "
3d " " ....S. 82 E. " 39 "
4th " " ....N. 56 E. " 43 "
5th " " ....N. 42 E. " 29 "
6th " " ....S. 59 W. " 16 "
Difference of latitude.. 27′.0 Departure .... 110′.2
True course..........N. 76° E. Distance............ 113 miles
Latitude in ....48° 52′ N. Longitude in........ 54° 31′ W.

Ex. 2. 1878, December 1st, in longitude 114° 45′ E. The observed meridian altitude of the sun's upper limb was 69° 26′ 40″ bearing S.; index error – 5′ 43″. Height of eye 21 feet. Required the latitude.

Ans. Sun's corrected declination .... 21° 47′ 50″ S.
Latitude .... 0° 47′ 49″ S.

Ex. 3. In latitude 69° 11′ S. the departure made good was 64.75 miles. Required the difference of longitude by parallel sailing.

Ans. Difference of longitude 182.2

Ex. 4. Required the course and distance from A to B by calculation on Mercator's principle.

Ans.
Latitude of A........ 17° 36′ N. Longitude..........146° 5′ E.
Latitude of B........ 23° 46′ N. Longitude..........121° 55′ W.
Difference of latitude.. 370
Meridian difference latitude 396
Difference of longitude 5520
Course .... N. 85° 54′ E. Distance........... 5175 miles

Ex. 5. 1878, October 21st, 5h:23m: A.M. apparent time at ship in latitude 47° 51′ S., longitude 30° 17′ E. The sun's magnetic amplitude was S.E.¼E. Required true amplitude and error of the compass, and supposing the variation to be 32° W., required the deviation of the compass for that position of the ship's head.

Ans.	Sun's corrected declination	10° 37′ 39″ S.
	True amplitude	E. 15° 58′ S.
	Compass correction	23° 13′ W.
	Deviation of the compass	5° 47′ E.

Ex. 6. 1878, December 28th, A.M. at ship in latitude 50° 55′ N., the observed altitude of the sun's lower limb was 10° 58′ 30″, index error – 1′ 20″. Eye at 20 feet. Time by chronometer 27d:20h:10m:54s:, which was slow for mean noon noon at Greenwich 2h:35m:53s: October 3d, and on October 21st was slow for mean noon at Greenwich 2h:34m:50s: Required the longitude by chronometer.

Ans.	Mean time at Greenwich December 27th	22h:41m:46s:
	Polar distance	113° 17′ 25″
	Sum of four logarithms	8.835525
	Mean time at ship December 27th	22h:00m:27s:
	Longitude	10° 19′ 45″ W.

Ex. 7. 1878, November 4th, 2h:46m: P.M. mean time at ship in latitude 53° 55′ 15″ N., longitude 163° 49′ 30″ E., the sun's magnetic azimuth was S.W.¾S. Observed altitude of the sun's lower limb 11° 13′ 10″. Eye at 18 feet. Index error — 1′ 20″. Required the true azimuth, correction and deviation of the compass. Variation of the compass 8° E.

Ans.	Mean time at Greenwich November 3d	15h:50m:42s:
	Polar distance	105° 19′ 54″
	Sum of four logarithms	19.126310
	True azimuth	S. 42° 54′ W.
	Compass correction	6° 20′ E.
	Deviation of the compass	1° 40′ W.

Ex. 8. 1878, June 21st, P.M. apparent time at ship, latitude by account 8° 10′ N., longitude 100° 33′ E., the observed altitude of the sun's lower limb bearing N. was 73° 45′ 30″. Eye at 12 feet. Index error – 0′ 00″. Time by watch 11h: 54m:10s P.M., which was found to be slow 26m:46s for apparent time at ship. The difference of longitude made to the west was 20 miles. Required the latitude by reduction to the meridian.

Ans.	Hour angle	19m:36s:
	Sun's corrected declination	23° 27′ 30″ N.
	Sun's true altitude	73° 57′ 43″
	Latitude	8° 07′ 30″ N.

Ex. 9. 1878, the observed meridian altitude of the star A. Aquilæ was 67° 42 30″, bearing S. Index error—3′ 10″. Eye 20 feet. Required the latitude.

Ans.	Star's declination	8° 32′ 45″ N.
	Latitude	30° 58′ 42″ N.

Ex. 1. No. 4.

Hours.	Courses.	Knots.	10ths.	Winds.	Leeway.	Deviat'n	Remarks, Etc,
1	S. by W. ¼ W.	3	9	West.	½	3°26′ w.	A point.
2	"	3	8	"			In latitude... ......49° 3′ S.
3	"	4	3	"			In longitude ..... 166° 12′ E.
4	"	4		"			Bearing by comp. SW by W ¾ W
5	South	5	3	W. by S.	¾	5°20′ E.	Head S. by E. Deviat'n 8° E.
6	"	5	7	"			Distance 21 miles.
7	"	5	4	"			Variation 20° E.
8	"	6	6	"			
9	N. by E.	8	3	East.	1	5° E.	
10	"	8	9	"			
11	"	8	9	"			
12	"	8	9	"			
1	W. by N. ½ N.	9	9	S.S.W. ½ W.	1¼	26° W.	
2	"	10	3	"			
3	"	10	4	"			
4	"	10	4	"			
5	W. by N.	10	4	North.	¼	22°30′ w	
6	"	10	4	"			
7	"	10	3	"			
8	"	9	9	"			A current set by compass N. 39° E. (correct magnetic) 8 miles from the time the departure was taken to the end of the day.
9	W.N.W.	9	9	S.W. by S.	¾	23° W.	
10	"	9	9	"			
11	"	10	1	"			
12	"	10	1	"			

Ans. {
Bearing corrected..................S. 87° E.
Current " ....N. 59 E.
1st course " ....S. 25 W. – Distance 16 miles.
2nd " " ....S. 17 W. " 23 "
3rd " " ....N. 25 E. " 35 "
4th " " ....N. 65 W. " 41 "
5th " " ....N. 84 W. " 41 "
6th " " ....N. 62 W. " 40 "
Difference of latitude.. 38′.6 Departure............ 84′.1
True courses..........N. 65° W. Distance.... ....93 miles.
Latitude in...........48° 24′ S. Longitude in..... ....164° 4′ E.

Ex. 2. 1878, November 16th, in longitude 171° 14′ E., the observed meridian altitude of the sun's lower limb was 71° 43′ 20″, bearing south. Index error – 1′ 30″. Height of the eye 24 feet. Required the latitude.

Ans. {
Sun's corrected declination.............................. 18° 40′ 22″ S.
Latitude.. .... 0° 33′ 27″ S.

Ex. 3. In latitude 68° 49′ N. the departure made good was 677 miles. Required the difference of longitude by parallel sailing.

Ans. Difference of longitude.................................... 1873

Ex. 4. Required the course and distance from A. to B., by calculation on Mercator's principle.

Ans. {
Latitude of A....... 4° 22′ S. Longitude .... 18° 21′ E.
Latitude of B....... 68° 20′ S. Longitude ....142° 15′ E.
Difference of latitude..... 3838
Meridian difference latitude.................................. 5423
Difference of longitude... 7434
Course........... S. 53° 53′ E. Distance ... . 6511 miles.

Ex. 5. 1878, March 21st, 9h: 10m: A.M., apparent time at ship, in latitude 10° 10′ N., longitude 118° 10′ E. The sun's magnetic amplitude was E.¼N. Required the true amplitude, and error of the compass, and supposing the variation to be 2° E., required the deviation of the compass for that position of the ship's head.

Ans.	Sun's corrected declination	0° 7′ 36″ N.
	True amplitude	E. 0° 8′ N.
	Compass correction	2° 41′ E.
	Deviation of the compass	0° 41′ E.

Ex. 6. 1878, March 21st, A.M., at ship in latitude 0° 0′ 0″ S., the observed altitude of the sun's lower limb was 36° 15′ 10″. Index error+2′ 38″. Eye at 20 feet. Time by chronometer, 20d: 13h: 21m: 50s., which was fast for mean noon at Greenwich 7m: 03.7s: January 11th, and January 20th was fast for mean noon at Greenwich 6m: 25s. Required the longitude by chronometer.

Ans.	Mean time at Greenwich, March 20th	13h: 19m: 41s.
	Polar distance	89° 52′ 30″
	Sum of four logarithms	9.307006
	Mean time at ship, March 20th	20h: 33m: 20s.
	Longitude	108° 24′ 45″ E.

Ex. 7. 1878, March 30th, 3h: 40m: 46s: P.M., mean time at ship, in latitude 28° 30′ 15″ S., longitude 174° 20′ W., the sun's magnetic azimuth was N. 80° 52′ 50″ W., observed altitude of the sun's lower limb was 28° 23′ 40″. Eye at 18 feet. Index error+5′ 10″. Required the true azimuth, correction, and deviation of the compass. Variation per chart, 12° 10′ east.

Ans.	Mean time at Greenwich, March 30th	15h: 18m: 6s.
	Polar distance	94° 4′ 37″
	Sum of four logarithms	19.485071
	True azimuth	N. 67° 06′ W.
	Compass correction	13° 46′ 50″ E.
	Deviation of the compass	1° 36′ 50″ E.

Ex. 8. 1878, November 16th, P.M., apparent time at ship, latitude by account 1° 20′ 30″ S., longitude 171° 00′ E., the observed altitude of the sun's lower limb bearing south was 71° 43′ 20″. Eye at 24 feet. Index error—1′ 30″. Time by watch on the 16th, 10h: 31m: 8s: P.M., which was fast 10h: 10m: 12s. for apparent time at ship. The difference of longitude made since to the east was 10 miles. Required the latitude by reduction to the meridian.

Ans.	Hour angle	21m: 36s.
	Sun's corrected declination	18° 40′ 37″ S.
	Sun's true altitude	71° 53′ 05″
	Latitude	1° 22′ 00″ S.

Ex. 9. 1878, the observed meridian altitude of the star A. Spica was 31° 27′ 40″, bearing north. Index error+5′ 20″. Eye at 20 feet. Required the latitude.

Ans.	Star's declination	10° 31′ 25″ S.
	Latitude	48° 01′ 25″ N.

Ex. 1.

No. 5.

Hours.	Courses.	Knots.	10ths.	Winds.	Leeway.	Deviat'n.	Remarks, Etc.
1	S.W.$\frac{3}{4}$S.	5	5	S.E.	1	6° 30′ W	A point.
2	"	5	5	"			In latitude........34° 28′ S.
3	"	5		"			In longitude.... ..18° 28′ E.
4	"	6		"			Bearing by Comp., S.E.$\frac{1}{2}$E.
5	N. by E.$\frac{3}{4}$E.	6	5	E. by S.	$1\frac{1}{4}$	12°30′ E	Head S.E. Dev. 4° 30′ E.
6	"	7	5	"			Distance 10 miles.
7	"	7		"			Variation, 24° W.
8	"	7		"			
9	E.$\frac{1}{2}$S.	7		N. by E.$\frac{1}{2}$E.	1	15° E.	
10	"	4	5	"			
11	"	4	5	"			
12	"	4		"			
1	N.E.$\frac{1}{2}$N.	6	5	S.E.$\frac{1}{2}$S.	$\frac{3}{4}$	13° E.	
2	"	6	5	"			
3	"	6		"			
4	"	6		"			
5	S.W.$\frac{1}{4}$S.	6	5	S.E.$\frac{1}{2}$E.	$\frac{1}{2}$	3° 45′ W	
6	"	6	5	"			
7	"	6	5	"			
8	"	6	5	"			A current set by compass
9	S.E.$\frac{1}{2}$E.	9	9	S.W. by W.	$\frac{1}{4}$	7° 25′ E.	S. 46° E. (corr't magnetic)
10	"	9	8	"			10 miles from the time the
11	"	9	7	"			departure was taken to the
12	"	9	6	"			end of the day.

Ans.
Bearing corrected.............................N. 70° W.
Current " ....S. 70 E.
1st course " ....S. 17 W—Distance 22 miles
2d " " .... N. 6 W. " 28 "
3d " " ....S. 82 E. " 20 "
4th " " ....N. 20 E. " 25 "
5th " " ....S. 20 W. " 26 "
6th " " ....S. 70 E. " 39 "
Difference of latitude.. 10′.2 Departure .... 46′.8
True course.......... S. 78° E. Distance............ 48 miles
Latitude in ....34° 38′ S. Longitude in........ 19° 25′ E.

Ex. 2. 1878, June 10th, in longitude 30° 30′ W. The observed meridian altitude of the sun's lower limb was 78° 19′ 40″ bearing N.; index error – 4′ 30″. Height of eye 20 feet. Required the latitude.

Ans.
Sun's corrected declination .... 23° 2′ 28″ N.
Latitude .... 11° 28′ 58″ N.

Ex. 3. In latitude 48° 28′ N., the departure made good was 187 miles. Required the difference of longitude by parallel sailing.

Ans. Difference of longitude .... 282′

Ex. 4. Required the course and distance from A to B by calculation on Mercator's principle.

Ans.
Latitude of A........ 30° 00′ N. Longitude .... 30° 00′ E.
Latitude of B....... 60° 00′ S. Longitude ....150° 00′ W.
Difference of latitude.. 5400
Meridian difference latitude 6415
Difference of longitude 10800
Course .... S. 59° 17′ E. Distance ....10571 miles

Ex. 5. 1878, January 1st, 6h:40m: A.M. apparent time at ship in latitude 30° 10′ S., longitude 100° 10′ W. The sun's magnetic amplitude was E.¾S. Required true amplitude and error of the compass, and supposing the variation to be 12° E., required the deviation of the compass for that position of the ship's head.

Ans.	Sun's corrected declination	22° 59′ 45″ S.
	True amplitude	E. 26° 52′ S.
	Compass correction	18° 26′ E.
	Deviation of the compass	6° 26′ E.

Ex. 6. 1878, March 29th, P.M. at ship in latitude 33° 8′ 15″ N., the observed altitude of the sun's lower limb was 27° 58′ 15″, index error 2′ 45″ to subtract. Eye at 20 feet. Time by chronometer 28d:17h:16m:28s:, which was slow for mean noon noon at Greenwich 1h:32m:17s: November 30, 1877, and on December 30th, 1877, was slow for mean noon at Greenwich 1h:28m:56s: Required the longitude by chronometer.

Ans.	Mean time at Greenwich March 28th	18h:35m:29s:
	Polar distance	86° 38′ 48″
	Sum of four logarithms	9.375588
	Mean time at ship March 29th	3h:58m:13s:
	Longitude	140° 41′ 00″ E.

Ex. 7. 1878, April 11th, 2h:7m:25s: P.M. mean time at ship in latitude 55° 27′ 45″ S., longitude 52° 06′ E., the sun's magnetic azimuth was N.½E. Observed altitude of the sun's lower limb 20° 56′ 45″. Eye at 20 feet. Index error—3′ 40″. Required the true azimuth, correction and deviation of the compass. Variation of the compass 36° W.

Ans.	Mean time at Greenwich April 10th	22h:39m:01s:
	Polar distance	98° 21′ 16″
	Sum of four logarithms	18.919596
	True azimuth	N. 33° 30′ W.
	Compass correction	39° 07′ W.
	Deviation of the compass	3° 07′ W.

Ex. 8. 1878, March 20th, P.M. apparent time at ship, latitude by account 44° 30′ N., longitude 119° 00′ W., the observed altitude of the sun's lower limb bearing S. was 45° 2′ 50″. Eye at 22 feet. Index error − 7′ 55″. Time by watch 0h:29m:58s: P.M., which was found to be fast 3m:30s: for apparent time at ship. The difference of longitude made to the east was 24 miles. Required the latitude by reduction to the meridian.

Ans.	Hour angle	28m:04s:
	Sun's corrected declination	0° 2′ 46″ N.
	Sun's true altitude	45° 5′ 39″
	Latitude	44° 31′ 00″ N.

Ex. 9. 1878, January 1st, the observed meridian altitude of the star A. Regulus was 84° 47′ 20″ bearing N. Index error + 4′ 20″. Eye 11 feet. Required the latitude.

Ans.	Star's declination	12° 33′ 40″ N.
	Latitude	7° 22′ 11″ N.

Ex. 1. No. 6.

Hours.	Courses.	Knots.	10ths.	Winds.	Leeway.	Deviat'n	Remarks, Etc.
1	N E by N¼N.	4	8	S.E. by E.	1¼	12° E.	A point. In latitude .. .... 30° 15′ S. In longitude ..... 40° 20′ W. Bearing by compass S. S. E. Head N.W. Dev. 4° 30′ W. Distance 10 miles. Variation 10° E.
2	“	4	9	“			
3	“	4	8	“			
4	“	5	5	“			
5	N.N.W.½W.	5	5	W. by S.	2	7°30′ W.	
6	“	5	3	“			
7	“	5	3	“			
8	“	5	3	“			
9	N.E.¼E.	4		S.E.½E.	2½	12°15′ E	
10	“	3		“			
11	“	3		“			
12	“	3		“			
1	N.½W.	4	9	W. by N.	2¾	2° E.	
2	“	5	8	“			
3	“	6	8	“			
4	“	7	5	“			
5	N.¾E.	7	1	E. by N.	2¼	13° W.	
6	“	6	3	“			
7	“	6	3	“			
8	“	6	3	“			A current set by compass N. 25° W. (correct magnetic) 48 miles from the time the departure was taken to the end of the day.
9	N.E.	5	4	N.W. by N.	1	7° E.	
10	“	4	8	“			
11	“	4	9	“			
12	“	4	9	“			

Ans.
Bearing corrected........................N. 17° W.
Current “ ....N. 15 W.
1st course “ ....N. 39 E. – Distance 20 miles.
2nd “ “ ....N. 3 W. “ 21.4 “
3rd “ “ ....N. 42 E. “ 13 “
4th “ “ ....N. 37 E. “ 25 “
5th “ “ ....N. 20 W. “ 26 “
6th “ “ ....N. 73 E. “ 20 “
Difference of latitude.. 152′.8 Departure.......... 30′.1
True courses...........N. 11° E. Distance.... .... 156 miles.
Latitude in...........27° 42′ S. Longitude in...... .. 39° 46′ W.

Ex. 2. 1878, January 14th, in longitude 51° 54′ W., the observed meridian altitude of the sun's upper limb was 78° 35′ 00″, bearing south. Index error + 5′ 55″. Height of the eye 18 feet. Required the latitude.

Ans.
Sun's corrected declination.............................. 21° 15′ 08″ S.
Latitude.. .... 9° 35′ 32″ S.

Ex. 3. In latitude 66° 40′ S. the departure made good was 387 miles. Required the difference of longitude by parallel sailing.

Ans. Difference of longitude....................................... 977.1

Ex. 4. Required the course and distance from A. to B., by calculation on Mercator's principle.

Ans.
Latitude of A....... 52° 30′ S. Longitude ....167° 30′ E.
Latitude of B....... 12° 20′ N. Longitude .... 92° 32′ W.
Difference of latitude................................ 3890
Meridian difference latitude........................... 4460
Difference of longitude.................. 5998
Course....... ... N. 53° 22′ E. Distance ... . 6519 miles.

Ex. 5. 1878, September 6th, 6h:40m: A.M. apparent time at ship in latitude 38° 40′ N., longitude 25° 45′ E. The sun's magnetic amplitude was E. by N. Required the true amplitude and error of the compass and supposing the variation to be 8° W., required the deviation of the compass for that position of the ship's head.

Ans.	Sun's corrected declination	6° 30′ 46″ N.
	True amplitude	E. 8° 21′ N.
	Compass correction	2° 54′ E.
	Deviation of the compass	10° 54′ E.

Ex. 6. 1878, August 20th, P.M. at ship in latitude 36° 41′ 20″ N., the observed altitude of the sun's lower limb was 23° 27′ 30″, index error - 3′ 10″. Eye at 19 feet. Time by chronometer 19d: 18h:10m:20s., which was slow for mean noon at Greenwich 24m:46s: June 12th, and on June 20th, was slow for mean noon at Greenwich 25m:30s. Required the longitude by chronometer.

Ans.	Mean time at Greenwich, August 19th	18h:41m:24s:
	Polar distance	77° 30′ 10″
	Sum of four logarithms	9.514859
	Mean time at ship, August 20th	4h:42m:24s:
	Longitude	150° 15′ 0″ E.

Ex. 7. 1878, June 4th, 6h:8m: P.M. mean time at ship, in latitude 47° 30′ N., longitude 16° 20′ W., the sun's magnetic azimuth was W.¼N. Observed altitude of the sun's lower limb was 33° 44′ 40″. Eye at 19 feet. Index error - 2′ 20″. Required the true azimuth, correction and deviation of the compass. Variation per chart, 32° W.

Ans.	Mean time at Greenwich, June 4th	7h:13m:20s:
	Polar distance	67° 30′ 22″
	Sum of four logarithms	19.676223
	True azimuth	S. 87° 04′ W.
	Compass correction	5° 45′ W.
	Deviation of the compass	26° 15′ E.

Ex. 8. 1878, November 23d, P.M. apparent time at ship, latitude by account 50° 30′ N., longitude 38° 30′ W., the observed altitude of the sun's lower limb bearing S. was 18° 49′ 14″. Eye at 20 feet. Index error - 4′ 19″. Time by watch 0h:26m:12s: P.M., which was found to be slow 2m:20s: for apparent time at ship. The difference of longitude made since to the west was 18 miles. Required the latitude by reduction to the meridian.

Ans.	Hour angle	27m:20s:
	Sun's corrected declination	20° 25′ 11″ S.
	Sun's true altitude	18° 54′ 13″
	Latitude	50° 26′ 00″ N.

Ex. 9. 1878, the observed meridian altitude of the star A Taurus was 50° 17′ 20″ bearing S. Index error + 3′ 10″. Eye 20 feet. Required the latitude.

Ans.	Star's declination	16° 15′ 54″ N.
	Latitude	56° 00′ 20″ N.

TO FIND THE LATITUDE AND LONGITUDE BY TWO OBSERVED ALTITUDES, THE RESULT OF EACH COMPUTATION BEING AT THE TIME AND PLACE WHERE THE GREATER ALTITUDE WAS TAKEN.

The system of double altitudes herein introduced has not heretofore been published in any American work, and its great advantage is that *both latitude and longitude* are thereby obtained simultaneously.

First. Be careful to note the times by the same chronometer at each observation, and apply its error to the time shown when the *greater altitude* was taken, to obtain the mean time at Greenwich.

Second. Take out the sun's declination on the given day from page two of the month of the nautical almanac, and correct it for Greenwich mean time by the hourly difference; the correction thus obtained is to be *added* when declination is *increasing*, but *subtracted* if *decreasing*.

Third. Then ascertain the angle between the ship's course and sun's bearing at the time of taking the *least altitude*, with which, and the ship's run between the observations, find the correction for change of position, and apply the same, if any, to the *least* altitude.

Fourth. If the less altitude be observed in the forenoon, *add* the *correction* thus found; if the angle is *less* than eight points, but if *more*, then *subtract it.*

Fifth. If the *less* altitude is taken in the afternoon, then *subtract* the *correction*, if the angle is *less* than eight points; but if *greater*, then *add it.*

Sixth. Should the angle between the ship's course and sun's bearing be equal to eight points or 90° degrees, then there is no correction to apply, because the lesser altitude is neither raised nor depressed.

Seventh. In sailing directly towards or from the sun, apply the correction for the change of position in the following manner, viz:

Eighth. When the *lesser altitude* is observed in the *forenoon* and sailing towards the sun, *add* the *correction* to the *lesser altitude;* but when sailing from the sun then *subtract* the correction from the *lesser* altitude.

Ninth. When the *less* altitude is taken in the *afternoon* and sailing but toward the sun, *subtract* the *correction* from the *least altitude;* when sailing from the sun, then add the correction to the *least altitude.*

Tenth. Correct each of the altitudes for index error, if any; dip of the horizon, (Table VII, Refraction Table VI, Parallax Table VIII), and sun's semi-diameter, Page 1 Nautical Almanac,) to be added to the sun's lower limb, but subtracted from the sun's upper limb to obtain the true altitude. Then proceed to find the latitude and longitude of the ship when the greater altitude was observed, by the following rules:

Eleventh. Add together the *true altitudes* and take half their sum; subtract the less altitude from the greater, and take half their difference.

Twelfth. Find the interval between the times of observing the two altitudes, which call *elapsed time;* take half of the elapsed time and reduce it to degrees, by Table XI.

Thirteenth. Add together the *co-secant* (Table II) of half the elapsed time, reduced as before, and the *secant* of the declination; their sum will be the *co-secant of arc first.*

Fourteenth. Add together the *co-secant* of *arc first,* the *co-sine* of half the sum of the altitudes and the *sine* of half their difference; the sum of these logarithms will be the *sine* of *arc second.*

Fifteenth. Add together the *secant* of *arc first,* the *sine* of half the sum of the altitudes, and the *co-sine* of half their difference, and the *secant* of *arc second;* their sum will be the *co-sine* of *arc third.*

Sixteenth. Add together the *secant* of *arc first,* already found, and the *sine* of the declination; their sum will be the *co-sine* of *arc fourth,* when the latitude and declination are of the *same name;* but when they are of *contrary names* take the supplement for *arc fourth,* that is from 180°.

Seventeenth. Take the sum or difference of arcs third and fourth, for arc fifth. (See rule 20.)

Eighteenth. Add together the secants of arc second (already found) and arc fifth, their sum will be the co-secant of the latitude when the greater altitude was observed, and the nearer it is taken to noon, the better. Having obtained the true latitude of the ship when the greater altitude was observed, proceed in the following manner to ascertain the longitude at the same instant.

Nineteenth. To the *co-secant* of *arc second add the co-sine* of the latitude just found, their sum will give the *co-secant of an arc in degrees and minutes*, which, converted into time by Table XI, produces *arc A*; the difference between it and the half elapsed time will give the apparent time at ship when the *greater altitude* is taken in the afternoon; but, should the *greater altitude* be observed in the forenoon, then *subtract* it from 24 hours to obtain the apparent time past the preceding noon, to which apply the corrected equation for the mean time at ship; the difference between it and the mean time at Greenwich by the chronometer will be the longitude in time when the greater altitude was observed, which being converted into degrees and minutes by Table XI, will produce the east longitude of the ship, if the time at ship be greater than Greenwich, but west, if less.

Twentieth. When the sum of arcs third and fourth is equal to, or greater than 90°, their difference is always arc fifth; but when their sum is less than 90°, which will rarely happen, it may be doubtful whether their sum or difference ought to be taken for arc fifth, but the computation is soon made on both suppositions, for the secant of arc fifth is the last logarithm which is taken from the table, and the other parts of the calculation are therefore not affected by the change; one of the results must certainly be the required latitude, and the latitude by account will generally be sufficient to determine which of them ought to be taken.

It may be useful to remark, the preceding not only applies to cases when the latitude and declination are of the same name, and very nearly alike in amount, in which case it becomes doubtful whether the sum or difference of arcs third and fourth should be taken to obtain arc fifth; hence it follows, such instances only occur between the tropics where the latitude by double altitudes is rarely observed, but should this method of ascertaining the ship's position be practiced when the sun is vertical, or nearly so, then it becomes absolutely requisite to work the arcs very rigidly to the nearest second, on account of the difference of the sines answering to small arcs, and co-sines of large ones varying so considerably; hence it is deemed advisable not to practice this method when the sun is within 5° of being vertical.

Ex. 1. April 13th, 1878, P.M., ship time at both observations in latitude by account 9° 50′ S., and longitude 10° 24′ W. Suppose the following true altitudes and times by chronometer were taken, to find the true latitude and longitude of the ship, the chronometer being 12m: 36s. slow of Greenwich time.

	H. M. S.
Time by chron. at greater alt.	1 13 30
Chronometer slow........ ....+	12 36
Mean time at Green. April 13.	1 26 06

Sun's dec. Apr. 13th.	9° 06′ 13″ N.	Hr. dif. 54″.30
	+ 1 16	1.4
Cor. dec....	9 07 29 N.	21720
		5430
		6,0)76.″020
		1′16″

1st true alt..	67° 58′		
2nd true alt.	42 20		
Sum......	110 18..	Half sum.	55° 09′
Difference ..	25 38..	Half dif..	12° 49′

	H. M. S.	
Time by chr. 1st obs.	1 13 30	
" " 2d "	3 24 20	
Elapsed time .....2)	2 10 50	
Half elapsed time..	1 5 25..	16° 21′ 15″

Half elap. time	16° 21′ 15″....	Co-secant..	0.550515				
Sun's dec.	9 07 29....	Secant	0.005521			Sine	9.200666
1st arc	16 08 00....	Co-secant..	0.556036....	Secant	0.017449....	Secant	0.017449
Half sum	55 09 00....	Co-sine....	9.756963....	Sine.......	9.914158		
Half difference	12 49 00 ...	Sine.......	9.340024....	Co-sine....	9.989042		
2d arc	27 08 00						
		Sine.......	9.659023....	Secant	0.050636		
3d arc.........	20 36 00			Co-sine....	9.971285		
						80° 29′....	9.218115
						180 00	
4th arc........	99 31 00					Co-sine..	99 31
5th arc........	78 55 00....	Secant	0.716164				
2d arc.........	27 08 00....	Secant	0.050636....	Co-secant..	0.340975		
Latitude in ...	9 51 00 S.	.Co-sec.....	0.766800...	Co-sine....	9.993550		
				Co-secant..	0.334525....	Arc A	27° 24′

	H. M. S.	
Arc A in time	1 50 16	
Half elapsed time........	1 05 25	
Apparent time at ship.............	0 44 51	
Equation time......................	+ 31	
Mean time at ship........	0 45 22	
Greenwich mean time.......	1 26 06	
Longitude in time	0 40 44	=10° 11′ W.

Ex. 2. April 11, 1878, A.M. ship time at both observations, in latitude by account 49° 10′ N., and longitude 6° 32′ W., when a chronometer showed 9h: 58m: 36s. A.M. being 10m: 42s. slow of Greenwich mean time, the altitude of the sun's lower limb 39° 45′ 50″, and at 11h: 48m: 34s. A.M. By the same chronometer, the altitude of the sun's lower limb was 48° 15′ 25″, the sun bearing *at least* altitude S. E. ¼ E., and the ship's course between the observations was N. E. ¼ N. The distance run being 14 miles; the height of the eye 18 feet, and index error 2′ 10″ to subtract. Required the true latitude and longitude of the ship, at the time of taking the *greater altitude.*

	H. M. S.		° ′ ″
Apr. 11, time by chr. at greater alt.	11 48 34 A.M.	Sun's dec. Apr. 11th	8 22 29 N.
	12 00 00	Cor. for G. T....	00 00
Astronomical time, April 10th....	23 48 34	Dec. for April 11th	8 22 29
Chronometer slow......	+ 10 42		
Mean time at Greenwich Apr. 10th	23 59 16		

Taken out for the 11 *as it wants but a minute from noon of that date.*

Sun's bearing when least altitude was taken...... S. E. ¼ E = S 4 ¼ points E.
Ship's course between the observation............ N. E. ¼ N = S 12 ¼ points E.

Angle between the ship's course and sun's bearing................8.... points.
Distance run 14 miles, with angle at 8 points, hence, no correction for change of position.

	° ′ ″		° ′ ″
First observed altitude......	39 45 50	Second observed altitude.............	48 15 25
Index error..........................	— 2 10	Index error.....................	— 2 10
	39 43 40		48 13 15
Dip, Table VII......................	— 04 04	Dip..........	— 04 04
	39 39 36		48 09 11
Refraction, Table VI........	— 1 08	Refraction................	— 51
	39 38 28		48 08 20
Semi-diameter.....	+ 15 59	Semi-diameter......	+ 15 59
True altitude............	39 54 27	Sun's second true altitude.....	48 24 19

	° ′ ″			H. M. S.
First true alt...	39 54 27		Time by chr. at 1st alt.	9 58 36 A.M.
Second true alt.	48 24 19		Time by chr. at 2nd alt.	11 48 34 A.M.
Sum.....	88 18 46	—Half sum. 44° 09′ 23″	Elapsed time...........	1 49 58
Difference.... .	8 29 52	—Half dif. 4° 14′ 56″	Half elapsed time......	0 54 59=13° 44′ 45″

	° ′ ″						
Half elapsed time..	13 44 45	....Co-secant.	0.623997				
Sun's declination...	8 22 29	....Secant...	0.004666			....Sine..	9.162885
First arc............	13 36 00	....Co-secant.	0.628663	...Secant...	0.012351	....Secant.	0.012351
Half sum...........	44 09 23	....Co-sine..	9.855833	....Sine....	9.842946		
Half difference.....	4 14 56	....Sine......	8.869868	....Co-sine..	9.998804		
Second arc....	13 04 00	....Sine......	9.354364	....Secant...	0.011393		
Third arc	42 48 00			....Co-sine..	9.865494		
Fourth arc..........	81 23 00					....Co-sine.	9.175236
Fifth arc...........	38 35 00	....Secant...	0.106959....				
Second arc..........	13 04 00	....Secant...	0.011393	....Co-secant	0.645729		
Latitude in.........	49 36 N.	....Co-secant.	0.118352	....Co-sine..	9.811655		
				Co-secant	0.457384	.... 20° 25′ arc A.	

	H. M. S.
Arc A in time...........................	1 21 40
Half elapsed time.......................	0 54 59
Time from noon, April 11th............	0 26 41
	24 00 00
Apparent time at ship, April 10th.....	23 33 19
Equation of time.........	+ 1 03
Mean time at ship, April 10th	23 34 22
Mean time at Greenwich, April 10th...	23 59 16
Longitude in time............	0 24 54..Long., 6° 13′ 30″ W.

NOTE.—Take out the equation for the 11th of April. *Name the latitude same name as latitude by account.*

Ex. 3. April 23, 1878, A.M. ship time at greater, and P.M. at lesser altitude, in latitude by account 39° 30′ S., and longitude 30° 12′ W. Time by chronometer, 1h: 36m: 15s. P.M., which was fast for Greenwich mean time 7m: 15s. when first altitude of the sun's *upper limb* was observed to be 38° 10′ 30″, and at 3h: 3m: 36s. P.M. the second altitude of the sun's *lower limb* was 36° 20′ 45″. Sun's bearing N. by W.¾. Ship's course between the observations N.N.E.½E. Distance run during the interval 10 miles. Index error 2′ 30″ to subtract. Height of the eye 22 feet. Required the latitude of the ship at the time of taking the greater altitude.

	H. M. S.		° ′ ″		
April 23, chr. showed...	1 36 15	Sun's dec. April 23....	12 34 56		
Fast for G. M. time....	— 7 15		1 14	Hourly diff....	49″.85
					1,5
	1 29 00	Correct declination....	12 36 10		
	24 00 00				24925
					4985
G. M. time, April 22....	25 29 00				6.0)7.4.775
					1′ 14″

Sun's bearing when *last* observation was taken................ N.byW. ¾ W.=N. 1¾ points W.
Ship's course during the elapsed time........................ N.N.E. ½ E.=N. 2½ points E.

Angle between the ship's course and sun's bearing............. 4¼

The angle between the ship's course and sun's bearing 4¼ points is to be taken as a course in Table III., and the distance run during the elapsed time (10 miles), as a distance, gives in the latitnde column, 6′ 7″=6′ 42, which is to be subtracted from the less altitude, the angle being less than eight points, and the less altitude having been taken in the afternoon.

UPPER LIMB.	° ′ ″	LOWER LIMB.	° ′ ″
First obs. alt.....................	38 10 30	Second obs. alt.....................	36 20 45
Index error..........................	— 2 30	Index error..........................	— 2 30
	38 08 00		36 18 15
Dip..................................	— 4 30	Dip..................................	— 4 30
	38 03 30		36 13 45
Ref..................................	— 1 13	Ref..................................	— 1 18
	38 02 17		36 12 27
Parallax............................	+ 08	Parallax	+ 8
	38 02 25		36 12 35
Semi-diameter......................	— 15 56	Semi-diameter......................	+ 15 56
True altitude........................	37 46 29	True altitude sun's center..........	36 28 31
		Correct.on for change of position..	— 6 42
		Sun's correct altitude...	36 21 49

ALTITUDES.	° ′ ″		TIMES. H. M. S.	
First alt.......	37 46 29		1 36 15 P.M.	Greater alt. obs.
Second alt	36 21 49		3 03 36 P.M.	Less alt. obs.
Sum...........	74 08 18	—Half sum. 37° 04′ 09″	1 27 21....	..Elapsed time.
Difference.....	1 24 40	—Half diff... 0° 42′ 20″	0 43 40....	..Half elapsed time.........10° 55′

	° ″						
Half elapsed time....	10 55	....Co-secant..	0.722663				
Declination..........	12 36	....Secant.....	0.010587			Sine.....	9.338742
Arc first..............	10 39	....Co-secant..	0.733250	....Secant...	0.007546	... Secant...	0.007546
Half sum of alt......	37 04	....Co-sine....	9.901967	....Sine.....	9.780133		
Half diff. of alt......	0 42	....Sine	8.086965	....Co-sine..	9.999966		
Arc second...........	3 01	....Sine.......	8.722182	....Secant...	0.000609		
Arc third.............	52 07	....	....	Co-sine..	9.788254		
Arc fourth...........	102 50	...=(180° —	77° 10′)	....	....	Co-sine,.	9.346288
Arc fifth.............	50 43	....Secant.....	0.198489				
Arc second...........	3 01	....Secant.....	0.000609				
LATITUDE IN.........	39 13 S.	.Co-secant..	0.199098				

Ex. 4. September 8, 1878, A.M., at ship in latitude 60° 10′ S. by account, and longitude 178° 45′ E., the altitude of the sun's lower limb was observed to be 19° 42′ at 10h:04m:20s: apparent time, the sun's center bearing N.N.E. by compass, and at 1h:32m:36s: P.M. by same chronometer, the second altitude was 21° 08′ 10″ (*being the greater*). The ship's course during the elapsed time was S.W. by S., and the distance run in the interval was 31 miles. Height of the eye 16 feet. Required the latitude of the ship at the time of taking the greater altitude.

	H. M. S.
Ap. time at ship at *greater altitude*.	1 32 36 P.M.
	24 00 00
	25 32 36
Long. in time...	11 55 00 E.
G. M. T. Sept. 7..	13 37 36

Long. 178° 45′ E.
4
60)715 00
=11 55

	° ′ ″
Sun's dec. Sept. 7th.	6 01 44
Correction	— 12 45
Correct declin.....	5 48 59 N.

Hourly dif.	56″.23
	13.6
	33738
	16869
	5623
	60)76.4.728
	12′.44″.728

Sun's bearing when *least altitude* was observed.....................	N.N.E.=N.	2 points E.
Ship's course during the elapsed time was.....	S.W. by S.=N.	13 pointsW.
Angle between the ship's course and sun's bearing....		15 points.
		16
To be taken out as a course, Table II, (and distance 31 miles).		1 point.

	° ′ ″
First observed altitude (least)...	19 42 00
Dip.......	— 3 50
	19 38 10
Refraction.....	— 2 40
	19 35 30
Parallax...........	+ 8
	19 35 38
Semi-diameter...........	+ 15 55
True altitude........	19 51 33
Correction for change of position.	— 30 24
Correct altitude.....	19 21 09 A.M.

	° ′ ″
Second observed alt. (greatest)....	21 08 10
Dip.........	— 3 50
	21 04 20
Refraction.........	— 2 27
	21 01 53
Parallax...........	+ 8
	21 02 01
Semi-diameter......	+ 15 55
True altitude....	21 17 56 P.M.

NOTE.—*The observation being in the forenoon, and angle more than 8 points, subtract the correction, 30° 24′.*

TRUE ALTITUDES.

	° ′ ″		
First obs. alt..	19 21 09		
Sec'd obs. alt..	21 17 56		
Sum ......:	40 39 05	—Half sum.	20° 19′ 32″
Difference.... .	1 56 57	—Half dif..	0 58′ 33″

TIMES.

	H. M. S.	
	10 04 20	A.M. *less altitude observed.*
(Add 12 hours.)	1 32 36	P.M. *greater altitude obs.*
	3 28 16	..Elapsed time.
	1 44 08	..Half elap. time, 26° 02′.

	° ′						
Half elapsed time..	26 02	......Co-secant .	0.357640				
Correct declination.	5 49	......Secant	0.002242	....		Sine	9.005805
Arc first............	25 54	......Co-secant .	0.359882	....Secant ..	0.045971	....Secant ..	0.045971
Half sum of alt....	20.19½	....Co-sine.. .	9.972081	Sine	9.540772		
Half dif. of alt.....	0 58½	....Sine	8.230029	....Co-sine .	9.999937		
Arc second.........	2 05	......Sine	8.561992	....Secant ..	0.000287		
Arc third...... ...	67 16	....		...Co-sine .	9.586967		
Arc fourth....	96 28=(180°—83° 32′)	... .				.Co-sine .	9.051776
Arc fifth......	29 12	......Secant	0.059025				
Arc second........	2 05	......Secant	0.000287				
LATITUDE IN........	60 44 S.	...Co-secant .	0.059312				

Ex. 5. September 9, 1878, A.M. at ship in latitude by account 6° 30′ N., at 18h: 16m: 20s: by a chronometer showing Greenwich mean time, the altitude of the sun's *lower limb* was 35° 10′ 30″, and at 20h: 36: 20s: by the same chronometer the altitude was 69° 49′ 30″; the height of the observer's eye 18 feet. Required the latitude at the time of taking the greater altitude.

	H. M. S.	
Gr. mean time Sept 8..	20 36 20	(at greater alt.)

	° ′ ″		
Sun's dec. Sept. 9..	5 16 33	Hourly dif.	56″.70
Cor. for 3h: 24m....	3 13		3.4
Corrected declin...	5 19 46 N.		22680
			17010
			60)19.2.780
			3′ 12″.780

Correction for 3h: 24m: from noon of the 9th to be added, as the declination is decreasing from noon of the 8th, and therefore we correct for the nearest noon.

	° ′ ″		° ′ ″
First obs. alt. sun's lower limb.......	35 10 30	Second observed altitude.............	69 49 30
Dip..................................	— 4 04	Dip..................................	— 4 04
	35 06 26		69 45 26
Refraction...........................	— 1 21	Refraction...........................	— 21
	35 05 05		69 45 05
Parallax.............................	+ 08	Parallax.............................	+ 03
	35 05 13		69 45 08
Semi-diameter	+ 15 55	Semi-diameter........................	+ 15 55
Sun's true altitude at first obs........	35 21 08	Second true altitude.................	70 01 03

TRUE ALTITUDES.	° ′		TIME BY CHRONOMETER. H. M. S.	
First altitude...	35 21		18 16 20	
Second altitude.	70 01		20 36 20	
Sum..........	105 22	—Half sum alt.. 52° 41′	2 20 00	—Elapsed time.
			1 10 00	—Half elap. time=17° 30′.
Difference.......	34 40	—Half dif. alt.. 17° 20′		

	° ′						
Half elapsed time..	17 30	Co-secant .	0.521858				
Sun's declination ..	5 20	Secant	0.001884			Sine	8.968249
Arc first............	17 25	Co-secant .	0 523742	Secant ..	0.020382	Secant ..	0.020382
Half sum of alt.....	52 41	Co-sine.. .	9.782630	Sine	9.900529		
Half dif. of alt....	17 20	Sine	9.474115	Co-sine .	9.979816		
Arc second.........	37 06½	Sine	9.780487	Secant ..	0.098271		
Arc third......	3 54			Co-sine .	9.998998		

{ When latitude and declination of same name, take the difference between third and fourth arcs for fifth arc. }

	° ′						
Arc fourth...... ...	84 24					Co-sine .	8.988631
Arc fifth......	80 20	Secant	0.782391				
Arc second.........	37 06	Secant	0.098224				
Latitude in....	7 34N	Co-secant .	0.880615				

NOTE.—The sum of the third and fourth arcs being less than 90°, this example admits of two answers. Read carefully the note in rules.

Ex. 6. November 10, 1878, in latitude by account 32° 32′ N., at 9h: 30m. A.M. the altitude of the sun's *lower limb* was 28° 14′, the bearing of its center by compass being S.E.½E.; and at the 11h: 17m: 42s. A.M. the altitude of the *upper limb* was 39° 08′, the height of the observer's eye being 18 feet, and the ship's course between the observations S. by E., running 7 knots per hour; required the latitude of the ship at the time of the greater altitude.

	H. M. S.		° ′ ″	
Time by chro	11 17 42 A.M.	Sun's declination Nov. 10	17 12 11..S.	hourly diff. 42″.08
	12 00 00	Correction for 42m: 18s	— 29″	7
M. T. G. Nov. 9	23 17 42	Correct declination Nov. 9	17 11 42 S.	29″.456

Sun's bearing at first observation	S.E.½E. or S.4½ points E.
Ship's course during the elapsed time	S. by E. or S. 1 point E.
Angle between the ship's course and sun's bearing	3½ points.

The elapsed time between the observation is 1¾ hours nearly, and the rate of sailing 7 miles per hour; that will give the distance run 12 miles, to be taken out as in example 3.

	° ′ ″		° ′ ″
First obs. alt. sun's *lower limb*	28 14 00	Second obs. alt. of sun's *upper limb*	39 08 00
Dip of the horizon	— 4 4	Dip of horizon	4 4
	28 09 56		39 03 56
Refraction	1 47	Refraction	1 10
	28 08 09		39 02 46
Parallax	8	Parallax	7
	28 08 17		39 02 53
Semi-diameter	+ 16 12	Semi-diameter	— 16 12
True alt. sun's center	28 24 29	True alt. sun's center	38 46 41
Correction for change of position	+ 9 18		
Sun's corrected alt	28 33 47		

TRUE ALTITUDES.			TIMES.
	° ′ ″		H. M. S.
First alt	28 33 47	..Less altitude.	9 30 00 A.M.
Second alt	38 46 41	..Greater altitude.	11 17 42 A.M.
Sum	67 20 28	..Half sum alt. 33°40′24″	1 47 42..Elapsed time.
			0 53 51..Half elapsed time=13° 27′ 45″
Difference	10 12 54	..Half diff. alt..5° 6′ 27″	

	° ′						
Half elapsed time	13 28	Co-secant	0.632869				
Sun's declination	17 12	Secant	0.019870			Sine	9.470863
Arc first	12 51½	Co-secant	0.652739	Secant	0.011044	Secant	0.011044
Half sum of alt	33 40	Co-sine	9.920268	Sine	9.743792		
Half difference alt.	5 06	Sine	8.949509	Co-sine	9.998277		
Arc second	19 27	Sine	9.522516	Secant	0.025519		
Arc third	53 05			Co-sine	9.778632		
Arc fourth	107 39	.=(180° — 72° 21′)				Co-sine	9.481907
Arc fifth	54 34	Secant	0.236755				
Arc second	19 27	Secant	0.025519				
Latitude in	33 09 N.	Co-secant	0.262274				

Ex. 7. July 7th, 1878, in latitude by account 58° 25′ N. and longitude 122° 30′ W. at 11h:02m:00s: A.M. per watch, the altitude of the sun's lower limb was 52° 53′, and at 1h:25m:00s: P.M. the altitude was 52° 44′, the sun at that time bearing S.W. by W. by compass; height of the observer's eye being 20 feet, and the ship's course during the elapsed time S.S.W.½W., the distance made in the interval was 18 miles; required the ship's true latitude at the time the greater altitude was observed.

Ans. Declination..22° 33′ 36″ N.
Latitude in..57° 22′ N.

Ex. 8. August 30th, 1878, in latitude 12° 43′ S. by account, and longitude 24° 15′ E. time by watch, 1h:13m:30s: P.M., the altitude of the sun's lower limb was 66° 09′ 30″, and at 3h:15m:12s: P.M it was 62° 00′ 15″, bearing at that time N.W. ½W.; course during the elapsed time S.W. by W. and distance sailed being 8 miles; height of the observer's eye, 28 feet; required the true latitude at the time of taking the greater altitude.

Ans. Declination..8° 58′ 28″ N.
Latitude in..11° 37′ S.

Ex. 9. November 11th, 1878, in latitude by account 32° 34′ N. at 9h:30m: A.M., the altitude of the sun's *lower limb* was 28° 18′, bearing by compass S.E., and at 11h:17m:42s: A.M., the second altitude of the sun's *upper limb* was 39° 10′; height of the observer's eye, 18 feet; and the ship's course between the observations was S. by E.; distance run during the interval, 12 miles. Required the latitude and longitude of the ship at the time of taking the *greater* altitude.

Ans. Declination..17° 28′ 24″ S.
Latitude in..32° 51′ N.
Longitude in..3° 10° 15′ W.

Ex. 10. February 25th, 1878, latitude in by account 49° 36′ N.; time by chronometer 0h:33m:00s: P.M., the observed altitude of the sun's lower limb was 28° 53′, and at 2h:43m:00s: P.M., by the same chronometer, the second altitude was 19° 14′, the height of the observer's eye being 14 feet. Required the latitude and longitude in at the time of taking the greater altitude.

Ans. Declination..9° 01′ 02″ S.
Latitude in..51° 17′ N.
Longitude in..5° 12′ 45″ E.

TO FIND THE LATITUDE BY THE POLE STAR.

The latitude by the meridian altitude of the pole star can be found at any time on a clear night in the northern hemisphere, by the following rules:

First. Correct the altitude for index error, if any, dip of the horizon and refraction; after being thus corrected, the altitude is *increased* if the star is below the pole, or decreased if the star is above the pole. This correction is found in Table ~~XV~~, XIX and applied thus:

Second. Find the sun's right ascension for the given day in the Nautical Almanac, to which *add* the apparent time at ship; if the sum of these exceeds 24 houre, reject 24 hours, and that will be the right ascension of the meridian.

Third. Enter Table XV, and in one of the side columns, opposite in the *center* column, will be found the correction in degrees and minutes.

Fourth. If the right ascension of the meridian is found in one of the *right-hand* columns, add the correction to the altitude; but if found in one of the *left-hand* columns, *subtract* the correction, and you have the latitude to be named North, *always*.

Ex. 1. December 31, 1878, mean time at ship 10h: 50m: 00s. P.M., in longitude 32° 30′ W. The observed altitude of the Pole star out of the meridian was 40° 20′ 10″. Index error, + 1′ 10″, eye 20 feet. Required the latitude in.

	H. M. S.		° ′ ″
Sun's right ascen., Dec. 10...	18 42 49	Obs. alt....................	40 20 10
Time of observation........	10 50 00	Index error.................	+ 1 10
	29 32 49		40 21 20
	24 00 00	Dip	— 4 17
Right ascension of meridian.	5 32 49		40 17 13
		Ref.......................	— 1 08
		Stars true alt...............	40 16 05
		Correction for table XV.....	— 36 00
		Latitude in..............	39 40 05N.

Ex. 2. February 12, 1878, mean time at ship, at 11h: 09: 00s. P.M. in longitude 35° 12′ W. The observed altitude of the Pole star was 41° 12′. Required the latitude. Eye 17 feet.

	H. M. S.		° ′ ″
Sun's right ascension........	21 44 07	Obs. alt....................	41 12 00
Time of obs................	11 09 00	Dip........................	— 3 57
	32 53 07		41 08 03
	24 00 00	Ref........................	— 1 05
R. A. of Meridian..........	8 53 07		41 06 58
		Correction	+ 36 00
		Latitude in..........	41 42 58N.

Ex. 3. September 10, 1878, mean time at ship at 2h: 30m: 15s. A.M. in longitude 30° 17′ W. The observed altitude of the Pole star, out of the meridian was 54° 00′ 30″; eye 18 feet; required the latitude in.

	H. M. S.		° ′ ″
Time of observation.....	2 30 15 A.M.	Obs. alt..................	54 00 30
(Add 12 hours).........	12 00 00	Dip.....................	— 4 4
	14 30 15		53 56 26
Sun's R. Ascension....	+11 14 42	Ref.....................	— 41
	25 44 57		53 55 45
	—24 00 00	Correction..............	—1 23 00
R. A. of Meridian......	1 44 57	Latitude................	52 32 45N.

Ex. 4. July 16, 1878, mean time at ship at 4h: 37m: 11s. A.M.—longitude 18° 30′ W. The observed altitude of the Pole star out of the meridian was 39° 54′ 20″; eye at 16 feet; index error + 5′ 10″; required the latitude in.

	H. M. S.		° ′ ″
Time of observation....	4 37 11 A.M.	Obs. alt.................	39 54 20
	+12 00 00	Index error.............	+ 5 10
	16 37 11		39 59 30
Sun's R. Ascension....	+7 42 33	Dip.....................	— 3 50
	24 19 44		39 55 40
	—24 00 00	Ref.....................	— 1′ 08
R. A. of Meridian......	0 19 44		39 54 32
		Correction...............	1 29 00
		Latitude in.............	38 25 32N.

Ex. 5. August 31, 1878, mean time at 2h: 40m: 20s: A.M. in longitude 85° 30′ E.; the observed altitude of the Pole star off the meridian was 20° 10′ 40″. Index error – 1′ 10″. Eye 20 feet. Required the latitude in.

Ans. Latitude in, 18° 38′ 38″ N.

Ex. 6. December 10, 1878, mean time at ship at 2h: 16: 04s: A.M. in longitude 76° 12′ E.; the observed altitude of the Pole star off the meridian was 47° 50′ 20″. Index error – 4′ 05″. Eye 13 feet. Required the latitude in.

Ans. Latitude in, 47° 48′ 57″ N.

Ex. 7. March 6, 1878, mean time at ship at 7h: 43m: 40s: P.M. in longitude 36° 58′ 45″ W.; the observed altitude of the Pole star off the meridian was 44° 30′ 30″. Eye 20 feet. Required the latitude in.

Ans. Latitude in, 44° 08′ 14″ N.

Ex. 8. January 16, 1878, mean time at ship at 9h: 38m: 00s: P.M. in longitude 59° 15′ E.; the observed altitude of the Pole star off the meridian was 67° 30′ 22″. Eye 20 feet. Required the latitude in.

Ans. Latitude in, 66° 49′ 41″ N.

TO FIND THE TIME OF A STAR'S PASSING THE MERIDIAN, ALSO, ITS APPROXIMATE ALTITUDE.

First. Find the star's right ascension as given in pages 242 to 245 in the American Nautical Almanac, next the sun's right ascension in page one for the month in the Almanac.

Second. Subtract the sun's right ascension from the star's right ascension, increasing the star's right ascension by 24 hours when the sun's right ascension is greater than the star's right ascension.

Ex. At what time will Arcturus be on the meridian on April 27, 1878.

	H. M. S.
Right ascension of Arcturus, April 27......	14 10 05
Sun's right ascension, April 27.............	2 15 06
Time of Arcturus' meridian passage........	11 54 59

By this method the time of any particular star passing the meridian can be found, and knowing at what time a star will pass the meridian, and having its approximate altitude at that time (as shown in the following example) there will be no difficulty in determining the latitude.

Third. *To find the approximate altitude of a star*, subtract the latitude in by account at the time of observation, from 90° which will give the co-latitude of the place of observation, find the star's declination in *Nautical Almanac*, as per rule, and *remember* that the sign thus — placed before the declination stands for south declination, and thus + stands for north declination.

Fourth. If the co-latitude and the star's declination are of the same *name*, take their *sum*, but if contrary *names* take their *difference*, for the altitude; the star will be found in the south part of the Heavens when the latitude is north, and in the north part when the latitude is south. When the sum of the co-latitude and the star's declination exceed 90°, subtract it from 180° and the remainder will be the altitude, but in this case the star will be found in the north part of the Heavens in north latitude and in the south part when the latitude is south.

Fifth. To find the star from its approximate altitude and meridian passage, set the index of the sextant to the approximate altitude, and a few minutes before the time of its meridian passage, direct the sight towards the north or south points of the horizon and the reflected image of the star will be perceived in the horizon glass, upon or near the horizon, the star then being brought in contact with the horizon and kept so until it arrives at its greatest or meridian altitude. There is not the least danger of mistaking the star as no two stars will have the same meridian altitude at the same time.

NOTE.—The best time for obtaining a correct altitude of a star is at twilight, for the horizon is then distinctly visible, and the latitude thus found is nearly as true as that obtained by an altitude of the sun, in dark nights, and in consequence of the obscurity of the horizon a large error may be found in the altitude; to counteract this the latitude should be found from an altitude of a star to the southward, and another to the northward, and half the sum of the two latitudes thus found will be the correct *latitude.*

Ex. 1. February 27, 1878, at ship in latitude by account, 40° 50′ 10″ N., required the time of the meridian passage of the star Aldebaran, and its approximate altitude.

	H. M. S.
February 27. Right ascension of Aldebaran from page 242 Nautical Almanac	4 28 55
Add 24 hours as the sun's right ascension is greater	24 00 00
	28 28 55
Sun's right ascension (page 1, Nautical Almanac)	22 41 41
Time of Aldebaran meridian passage	5 47 14 P.M.

	° ′ ″
Latitude by account	40 50 10 N.
	90 00 00
Co-latitude	49 09 50 N.
Star's declination, Nautical Almanac page 242	16 05 45 + N.
Approximate altitude	65 15 35

Set the index of the sextant to this altitude and sweep the horizon to the southward, as the latitude is north, and the star will be distinctly seen near the horizon; watch it closely, and when it has ceased to rise, it is on its meridian, then apply the usual rules to find the latitude.

Ex. 2. March 21, at ship, in latitude by account, 1° 30′ 25″ S., at what time will the star Sirius pass the meridian, and what will be its approximate altitude?

	H. M. S.
March 21. Sirius' right ascension	6 39 46
Sun's right ascension	0 2 47
Time of Sirius' meridian passage	6 36 59 P.M.

	° ′ ″
Latitude in by account	1 30 25 S.
	90 00 00
Co-latitude	88 29 35 S.
Star's declination	16 32 59 — S.
	105 02 34
	180 00 00
Approximate altitude	74 57 26 Toward the south

NOTE.—See page 71 for finding the latitude by a star.

Ex. 3. May 1, 1878, at ship, in latitude by account, 20° 00′ 00″ N., required the meridian passage of the star, Vega, and its approximate altitude.

May 21. Vega right ascension	18° 32′ 48″
Sun's right ascension	2 34 05
	15 58 43
	12 00 00
Time of Vega meridian passage	3 58 43 A.M.
Latitude in by account	20° 00′ 00″ N.
	90 00 00
Co-latitude	70 00 00 N.
Star's declination	38 40 16+N.
	108 40 16
	180 00 00
Approximate altitude	71 19 44 Toward the north.

TO FIND THE TIME AT ANY GIVEN MERIDIAN BY THE SUN'S ALTITUDE.

Take any number of altitudes with their corresponding times by watch, or chronometer, when the sun bears as nearly east or west as possible, of which take the "means," *add them all together and divide the number of observations.*

To these means of the altitudes apply the corrections, as *usual*, and get the true altitude of the sun's centre.

Take the sun's declination (page 2, Nautical Almanac), and correct it by the *hourly difference* for the mean time at Greenwich, and get the sun's polar distance, adding the declination to 90° when the latitude and declination are of contrary names; subtracting it from 90° when they are of the same name, N. or S.

Correct the equation (page 1, Nautical Almanac) for the mean time at Greenwich.

Add together the sun's *polar distance*, ship's *latitude* and sun's true *altitude;* take half the sum, and, lastly, the difference between that and the true altitude; call this the *remainder.*

Add together the *secant* of the *latitude; co-secant* of the *polar distance; co-sine* of the *half sum; sine* of the *remainder;* and the sum, rejecting tens in the index, will be the log. (Table XVIII.) answering to the *hour angle* or *apparent time, from noon*, at which the observation was taken.

If the observations be made in the morning, the time thus found must be taken from 24 hours to obtain the apparent time from the preceding noon.

To the apparent time thus found, apply the reduced equation of time, by addition or subtraction, as directed at the head of its column on page 1 of the Nautical Almanac, and the sum or remainder will be the *mean time* at the ship or place of observation. Hence, the error of the watch at the meridian of the place may be found for both apparent and mean time.

Ex. 1. August 16th, apparent time at ship 4h:42m:06s: in latitude 36° 31′ N. and longitude by account 152° 00′ E., the observed altitude of the sun's lower limb was 23° 50′ 24″; height of the observer's eye being 18 feet. Required the true, apparent and mean time at ship, and the error of the watch.

		H. M. S.
Apparent time at ship, August 16....		4 42 00
Longitude......	152° 00′	24 00 00
	4	
		28 42 00
	6.0)60.8 00	
	10h:08m.	
Longitude in time..................		10 08 00
Greenwich apparent time, Aug. 15...		18 34 00

	° ′ ″		
Sun's dec. Aug. 16..	13 43 02	Hr. dif.	47″.46
Cor. for 5h:26m....	4 16		5 4
Dec. at Gr. M. T...	13 47 18 N.		18984
	90 00 00		23730
Sun's polar distance	76 12 42		6.0)25.6.284
			4′ 16″

Take the declination out for the 16th of August, and correct it for 5h:26m: from the noon of the 16th, towards the 15th, the first being the nearest noon, and add the correction as the declination is decreasing, that will give the declination at Greenwich mean time on August 15th.

	° ′ ″		M. S.		
Observed altitude.....	23 50 24				
Dip......	— 4 17	Equation of time..	4′05.56	Hourly dif.	509
			2.74		54
	23 46 07				
Correction Table XIII.	— 2 00		4 08.30		2036
	23 44 07				2545
Sun's semi-diameter...	15 50				2″.7486
Sun's true altitude....	23 59 57				
Latitude	36 31 00	....Secant.........	0.094915		
Polar distance...... ..	76 12 42	....Co-secant...... ...	0.012699		
Sum............ ....2)	136 43 39				
Half sum.............	68 21 49	....Co-sine.....	9.566691		
Remainder............	44 21 52	....Sine.......	9.844614		
	H. M. S.				H. M. S.
Apparent time at ship.	4 40 39	....Log. Table XVIII.	9.518919	....	4 40 39
Equation of time......	4 08			Time by watch............	4 42 06
Mean time at ship.....	4 44 47			Watch *fast* for app. time...	0 1 27
Time by watch.........	4 42 06				
Watch *slow* for M. T...	0 2 41				

Ex. 2. March 15, 1878, A.M. at ship, when a watch showed 6h:44m:49s: latitude in at time of observation 16° 29′ N., and longitude 99° 30′ W., the observed altitude of the sun's lower limb was 10° 36′ 10″; the error of the sextant was 2′ 50″ to subtract; eye 22 feet. Required the apparent and mean time at the meridian of ship, and the error of the watch.

	H. M. S.
Time by watch	6 44 49 A. M.
	12 00 00
Apparent time at ship, March 14.	18 44 49
Long. in time	6 38 00 W.
	25 22 49
	24 00 00
Apparent time at Greenwich	1 22 49

	° ′ ″	
Sun's dec. March 15	2 04 07	Hr. dif. 59.18″
Correction for 1h:23m	— 1 17	1.3
		17754
		5918
Sun's declination at Green. mean time.	2 02 50 S.	
	90 00 00	60)7.6.934
Sun's polar distance	92 02 50	1′16″934

	° ′ ″		M. S.	
Observed altitude	10 36 10	Equation of time.	9 04.55	H. dif. 717
Index error	— 2 50		— .93	13
	10 33 20	Correct equation.	9 03.62	2151
Dip	— 4 30			717
	10 28 50			9321
Correction Table XIII	— 4 53			
	10 23 57			
Sun's semi-diameter	+ 16 06			
	10 40 03			

	° ′ ″		
Sun's true altitude	10 40 03		
Latitude	16 29 00	Secant	0.018226
Polar distance	92 02 50	Co-secant	0.000278
Sum	2)119 11 53		
Half sum	59 35 56	Co-sine	9.704179
Remainder	48 55 53	Sine	9.877340

	H. M. S.		H. M. S.
Appparent time from noon	5 12 59	Log. Table XVIII	9.600023
	24 00 00		
Apparent time at ship	18 47 01		18 47 01
Equation of time	+ 9 03	Time by watch	18 44 49
Mean time at ship	18 56 04	Watch *slow* for app. time.	0 2 12
Time by watch	18 44 49		
Watch *slow* for mean time	0 11 15		

TO FIND THE ERROR OF A WATCH OR CHRONOMETER BY EQUAL ALTITUDES OF THE SUN.

Subtract the first time from the second, for the interval.

Add the two times, and divide the sum by 2, for the middle time by chronometer. Get the difference between the declination of the day before and day after, for the change of declination in two days, and multiply the difference by 60, which will give seconds.

Correct the sun's declination for the Greenwich time and date, and the longitude in time, if west, it is the Greenwich time; but if east, take the longitude in time from 24 hours, and call the day one back.

Correct the equation of time for the Greenwich time, as usual; taking it out of page 2, Nautical Almanac. From Table XVI. take out log. A. and B. for the interval, and place the log. of natural number (Table I.), for the change of declination in two days under both log. A. and B. The log. tangent (Table II.) of the latitude under log. A. and log. tangent of the declination under log. B.

**See note for Table XVI.*

The sum of the first three logs. is the log. in logarithms of numbers (Table I.) of the *first part* of the equation of equal altitudes, and the sum of the last three logs., that is, log. B., log. of change of declination, and log. tangent (Table II.) of the corrected declination, will be the *second part* of the equation of equal altitudes.

The *first* part of the equation is *additive* when the declination is decreasing, and of the same name with the latitude, or increasing, and of a different name from the latitude; but *subtractive* when the declination is increasing, and of the same name with the latitude, or decreasing, and of a different name from the latitude.

The *second* part of the equation is *additive* when the declination is increasing, but subtractive when the declination is decreasing.

When both parts are additive or subtractive, get the sum of them and apply them to the middle time by chronometer (according to the sign + or —). But if one is *additive* and the other *subtractive*, take *their difference* and apply it to the middle time by chronometer, according to the sign of the greater.

Apply the equation of time corrected for longitude to the apparent noon at place, as directed at head of column, page 1 of the month Nautical Almanac, for the mean time at place of *observation.*

Get the difference between the time by chronometer at apparent noon and mean time at place, and call the chronometer fast or slow, as shown by the times.

NOTE.—Table XVI. contains but four place of figures, besides the index figures; therefore, in taking out the logarithms from Table I., only take out the first four figures, increasing the fourth figure by one when the remaining figures exceed 50. Do the same with the log. tangent.

EQUATIONS OF EQUAL ALTITUDES.

Ex. 1. August 5, 1878, in latitude 37° 35′ N. and longitude 60° 00′ W., the following times were noted down when the sun had equal altitudes. Required the error of the watch for mean time at place of observation.

	A.M.		P.M.
	H. M. S.		H. M. S.
	7 25 40		1 33 06
	7 26 23		1 32 23
	7 27 06		1 31 40
	3)79 09		3)97 09
Means	7 26 23	Means	1 32 23
Add 12 hours	12 00 00	Add 24 hours	24 00 00
August 4	19 26 23	August 5	25 32 23

	H. M. S.		H. M. S.
	25 32 23 P.M.		25 32 23
	19 26 23 A.M.		19 26 23
Interval	6 06 00	Sum of times	2)44 58 46
		Middle time by chronometer	22 29 23

Sun's declination August 4	17° 13′ 41″ N.
Sun's declination August 6	16 41 08 N.
Difference of declinations in two days	0 32 33
	× 60
In seconds	1953

Dec. Aug. 5.	16° 57′ 33″ N.	H. dif. 40″.70	Eq. of time Aug. 5.	M. S. 5 46.73	H. dif. 248
Cor. for long.	— 2 40	4	Cor. for lon. in time	— .99	4
Reduced dec.	16 54 53 N.	6)162″80	Red'd eq. of time	5 45.74	99.2
		2′ 40″			
Longitude	60° 00′				
	4				
	60)240 00				
	4h:00 W.				

Interval of time (Table XVI).	6h:06m:	Log. A. 7.7719	Opp. Log. B.	7.6156
Change of declination for two days, log. of numbers Ta. I.	1953	Log. 3.2907	Same Log.	3.2907
Latitude (Tangent Table II).	37° 35′	9.8863	Dec. tan. T. II.	9.4831
First part	+8″.89	0.9489		
Second part	−2″.45		Log.	0.3894
Equation of equal altitudes	6″.44			

	H. M. S.		H. M. S.
Middle time by chron.	22 29 23.0	Middle app. time at ship	24 00 00
Equation of equal altitudes	+ 6.5	Equation of time	+ 5 45
Time by chron. at ap. noon	22 29 29.5	Mean middle time at ship	24 5 45
Mean middle time at ship	24 05 45		
Chron. *slow* for mean time	1 36 16	at place of observation.	

Ex. 2. October 4, 1878, in latitude 39° 19′ S. and longitude 90° 00′ E., the following times were noted when the sun had equal altitudes. Required the error of the watch for mean time at place of observation.

	A.M.		P.M.
	H. M. S.		H. M. S.
	7 00 05		11 50 03
	7 00 55		11 50 53
	7 01 30		11 51 34
	3)2 30		3)152 30
	7 00 50		11 50 50
Add 12 hours	12 00 00	Add 12 hours	12 00 00
October 3	19 00 50	October 3	23 50 50

	H. M. S.		H. M. S.
	23 50 50	Second time	23 50 50 A.M.
	19 00 50	First time	19 00 50 A.M.
Interval	4 50 00	Sum of times	2)42 51 40
		Middle time by chronometer	21 25 50

	° ′ ″
Declination October 3	4 01 06 S.
Declination October 5	4 47 27 S.
Change of declination in two days	46 21
	× 60
In seconds	2781

	° ′ ″		
Declin. Oct. 3	4 01 06	Hr. dif.	58″.06
Cor. for 18h.	+ 17 25		18
Reduced dec.	4 18 31		46448
			5806
	90° 00′		6,0)1045,08
	4		17′ 25″
	)360		
Long. in time.	6h:00m.		
	24h:00m.		
	18h:00m.		

	M. S.		
Equation of time	10 57.41	Hr. dif.	770
	+ 13.86		18
Correct equation	11 11.27		6160
			770
			60)13″.860

Take the longitude in time from 24 hours as the ship is to the east of Greenwich, and take the declination out for the 3rd of October.

Interval	4h:50m:	Log.A.	7.7541	Log. B.	7.0603
Change of declin. in 2 days	2781	Log	3.4442		3.4442
Latitude	36° 19′ S.	Tangent	9.8663	Dec. T't 4° 19′	8.8778
First part	— 11″.60	Lcg	1.0646		
Second part	+ 0″.96				9.9826
Equation equal altitudes	10″.64				

	H. M. S.		H. M. S.
Middle time by chron.	21 25 50.0	Mid. ap. time at ship noon.	24 00 00.0
Equation of equal altitudes.	— 10.6	Equation of time	— 11 27.2
Time by chron. at ap. noon.	21 25 39.4	Mean middle time at ship.	23 48 32.8
Mean middle time at ship.	23 48 32.8		
Chr. *slow* for M. T. at place.	2 22 53.4		

Ex. 3. April 6, 1878, in latitude 32° 40′ S. and longitude 153° 00′ E., the following times were noted when the sun had equal altitudes. Required the error of the watch for mean time at place of observation.

	A.M. H. M. S.		P.M. H. M. S.
	9 28 20		2 33 43
	9 29 01		2 33 02
	9 29 58		2 32 05
	9 30 56		2 31 07
	9 31 44		2 32 39
	5)149 59		5)160 36
Means	9 29 59	Means	2 32 07
Add 12 hours	12 00 00	Add 24 hours	24 00 00
	21 29 59 A.M.		26 32 07 P.M.

	H. M. S.		H. M. S.
First time	26 32 07 P.M.		26 32 07
Second time	21 29 59 A.M.		21 29 59
Interval	5 02 08	Sum of times	2)48 02 06
		Middle time by chronometer	24 01 03

Declination April 5	° ′ ″ 6 08 03 N.
Declination April 7	6 53 21
Difference of declination in two days	45 18
	× 60
In seconds	2718

	° ′ ″		″
Dec. April 5.	6 08 03 N.	Hr. dif.	56.89
Cor. 13h:48m	+ 13 05		13.8
Reduced dec.	6 21 08 N.		45512
			17067
Longitude	153° 00′ E.		5689
	4		6,0)78,5,082
	6,0)61,2 00		13′ 05″
Long. in time	10h:12m:		
From 24 hours	24h:00m:		
Gr. time 5th.	13h:48m:		

	M. S.		
Equation of time.	2 44 65	Hr. dif.	728
	— 10 04		138
Correct-equation.	2 34 61		5824
			2184
			728
			6,0)10,0464

Interval of time	5h:02m:08s:	Log. A	7.7566	Log. B	7.6546
Change of dec. in 2 days.	2718	Log. of No.	3.4342		3.4342
Latitude	32° 40′ S.	Tangent.	9.8070	Dec. tan. 6° 21′	9.0464
First part	+ 9″.95	Log	0.9978		
Second part	+ 1″.36			Log	0.1352
Equation of equal alt.	11″.31				

	H. M. S.		H. M. S.
Middle time by chron.	24 01 03.0	Mid. ap. time at ship noon.	24 00 00.0
Equation of equal altitudes.	÷ 0 11.3	Equation of time	+ 2 34.6
Time by chron. at ap. noon.	24 01 14.3	Mean middle time at ship.	24 02 34.6
Mean middle time at place.	24 02 34.6		
Chronometer slow	0 1 20.3		

TO FIND THE SHIP'S POSITION FROM TWO BEARINGS OF THE SAME OBJECT.

This method of finding the position of the ship when in sight of land, by two bearings of the same object, will be found of great value when a cross-bearing cannot be obtained:

Select an object, the latitude and longitude of which is known; take a correct bearing of it by the compass (apply the variation and deviation due the compass bearing), and note the time by watch. After the bearing has altered not less than three points, take a second bearing, and note the time by watch. Having the interval of time between the first and second bearings, and the rate of sailing per hour, the distance sailed in the interval of time between the first and second bearings, and the rate of sailing per hour, the distance sailed in the interval may easily be obtained, and the ship's correct latitude and longitude found, as explained in the following example and table:

Ex. 1. April 15. at 8h. P.M., a light-house bore by compass N.W. ½ N.; ship's course, W.; sailing at the rate of 7 miles per hour till 10h: P.M., when the same light bore N.N.E. ½ E. Required her distance at both places:

First bear., N.W. ½ N. } Second bear. N.N.E. ½ E. }
Course west......... } Angle 4½ pts. Course west............. } Angle 10½ pts.
Found at top of table. } *Found at side of the table.* }

With 4½ pts. at the top of table, and 10½ pts. at the side of table,
give the tabular number............ .... 0 84
Distance sailed in 2 hours.................................... + 14
11 76

The tabular number multiplied by 14, the distance run in two hours, and the two right-hand figures struck off (being decimals) gives the distance off at 10h: P.M., 11¾ miles.

To find the distance:

The first angle being.. 4½ pts The second angle..10½ pts. The tabular number is.. 0 95
Subtracted from.......16 ,, Subtracted from...16 ,, Distance made........... — 14
Taken from side table..11½ Taken at the top... 5½ 380
95
.... 13 30

Gives the distance at 8h: P.M., 13¼ miles.

Ex. 2. At 5 o'clock A.M., a light-house bore by compass W. by S. ½ S. Ship then sailed on a S. ½ W. course, at the rate of 5½ knots an hour, until 7 A.M., when the same object bore N.W. by N., variation ½ point west. Required the ship's latitude and longitude at the time of each bearing.

1st bearing W. by S. ½ S. by compass. 2d bearing N.W. by N. by compass.
Corr. for ½ pt. W. var. is W.S.W. } Angle 6 pts. Corr. for ½ pt. var. N. W. ½ N. } Angle 12½ pts.
Course S. ½ W. ,, South, } Course..... ....true S. }
Tabular number.....97
2 hours and 5½ knots=Distance sailed.......11

Distance off at time of second bearing at 7 A.M.........10 67 miles.

The op. pt. to 2d bear. is S.E.½S., dist. 10½ ms., D. Lat.. 0° 8′ S. Dep. 6.7=D. Long. 0° 8′ 45″ E.
Latitude of light-house. ..40 24 N. Long of light......73 58 48 W.

At 7 A.M. the latitude of the ship was............40 16 N. Long...............73 50 3 W.

To Find the Position of the Ship at 5 A.M., or Time of First Bearing.

1st Angle was...................... 6 points. 2d Angle was..................12½ points.
Subtract from....................16 „ Subtract from.................16 „

Look for....................... ....10 points at the side of the table, and...... 3½ at top.
Tabular number............ 66
Distance sailed.............. 11

Dist. off at time of 1st bear. 5 A.M.......7.26′, or 7¼ miles, nearly.

The op. pt. to 1st bear. is E.N.E., dist. 7½ gives Dif. Lat. . 0° 3′ N. Dep. 6.7=D. Long. 0° 8′ 45″ E.
Latitude of light-house.........40 24 N. Lon..73 58 48 W.

At 5 A.M. the latitude of the ship was...........40 27 N. Lon..73 56 3 W.

The ship having made her true south course, she has sailed on the meridian of 73° 50′ 3″ west, and was in the same longitude at 7 A.M. as at 5 A.M. and her difference of latitude is equal to the distance sailed.

Ex. 3. At noon a point of land bore SE. by E. by compass. Ship then sailed on a south course, at the rate of 10 knots an hour, until 4 P.M., at which time the same point of land bore N.E. by E. ½ E., the magnetic variation here being 1½ points westerly. Required the latitude and longitude of the ship at the time of each bearing.

The 1st Bear. SE. by E. by compass.
Cor. for 1½ pts. W. var.=E. by S. ½S. } Ang. 5 pts.
Course south, corr.=S. by E. ½ E. }

2d Bear. N.E. by E. ½ E. by compass.
Cor. for 1½ pts. var.=N.E. } Angle 10½ pts.
True course....S. by E. ½ E. }

Tabular number.................................. 0.94
4 hours at 10 knots.................................. 40

Dist. off at the time of the 2d bearing, at 4 P.M..... 37.60 miles.

The op. pt. to 2d bear. is S.W. dis. 37½ mls., gives D.Lat. 0° 26′ 30″ S. Dep. 26.5=D.Long. 0° 27′ 40″ W.
Latitude of NW. point of land........ ....17 12 0 N. and Lon..........25 19 0 W.

At 4 P.M. latitude of the ship was....... ..16 45 30 N. and Lon..........25 46 50 W.

To Find the Position of Ship at Noon, or Time of First Bearing.

The 1st Angle was... 5 points. 2d Angle was....10½ points.
Subtract from.......16 " Subtract from...16 "
11 pts. at the side of table, and. 5½ at the top. } Tabular No...1.00
Dist. sailed... 40

Dist off at the time of 1st bearing, or noon.................40.00 miles.

The op. pt. to 1st bear. is W. by N. ½N., dist. 40=D.Lat.. 0° 11′ 36″ N. Dep. 38.3 W. D.Lon. 0° 40′ W.
Lat. N.W. point of land is.... ....17 12 0 N. Lon..25 19 W.

Lat. of the ship at noon was.. ......17 23 36 N. Lon..25 59 W.

TABLE FOR FINDING THE DISTANCE OF AN OBJECT BY TWO BEARINGS, AND THE DISTANCE BETWEEN THEM.

First. To find the distance of the object when the last bearing was taken, enter the table with the number of points at the top, contained between the first bearing and the ship's head, and the number of pointsat the side contained between the second bearing and the ship's head. At the angle of meeting take out the tabular number which multiply by the number of miles of distance made good by the ship. The result is the distance in miles off shore at the time the last bearing was taken.

Second. To find the distance when the first bearing was observed, enter the table with the difference between these bearings and 16 points; the second bearing in this case must be taken from the top, and the first bearing from the side column. Take out the tabular number corresponding and multiply it by the number of miles of distance made good by the ship. The result is the distance of the ship off shore at the time of the first bearing.

Difference between the course and 2nd bearing.	DIFFERENCE BETWEEN THE COURSE AND THE FIRST BEARING.																
	POINTS OF THE COMPASS.																
POINTS.	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10
3½	1.00																
4	1.00																
4½	0.81	1.23															
5	0.69	1.00	1.45														
5½	0.60	0.85	1.17	1.66													
6	0.54	0.74	1.00	1.35	1.85												
6½	0.49	0.67	0.88	1.14	1.50	2.02											
7	0.46	0.61	0.79	1.00	1.27	1.64	2.17										
7½	0.43	0.57	0.72	0.90	1.11	1.39	1.77	2.30									
8	0.41	0.53	0.67	0.82	1.00	1.22	1.50	1.87	2.41								
8½	0.40	0.51	0.63	0.76	0.92	1.09	1.31	1.58	1.96	2.50							
9	0.39	0.49	0.60	0.72	0.85	1.00	1.18	1.39	1.66	2.03	2.56						
9½	0.38	0.48	0.58	0.69	0.80	0.93	1.08	1.25	1.46	1.72	2.08	2.60					
10	0.38	6.47	0.57	0.66	0.76	0.88	1.00	1.14	1.31	1.51	1.76	2.11	2.61				
10½	0.38	0.47	0.56	0.65	0.74	0.84	0.94	1.06	1.19	1.35	1.53	1.79	2.12	2.60			
11	0.39	0.47	0.56	0.64	0.72	0.81	0.90	1.00	1.11	1.24	1.39	1.57	1.80	2.11	2.56		
11½	0.40	0.48	0.56	0.63	0.71	0.79	0.87	0.95	1.05	1.15	1.27	1.41	1.58	1.79	2.08	2.50	
12	0.41	0.49	0.57	0.64	0.71	0.78	0.85	0.92	1.00	1.08	1.18	1.29	1.41	1.57	1.76	2.03	2.41
12½	0.43	0.51	0.58	0.65	0.71	0.77	0.83	0.90	0.97	1.03	1.11	1.29	1.29	1.41	1.35	1.72	1.96

EXPLANATIONS OF THE TABLES.

TABLE I.—*Logarithms of numbers.*

The decimal point separates the two parts of a logarithm, the integer before it, called the index, and the decimal part after it.

The index is governed by the number of figures in the whole number, being always one less than this number. The index of 12 is 1; of 999, it is 2; 1999, it is 3.

If the number is a mixed decimal, the decimal is not taken into account in finding the index, the whole part only being used. Index of 23.45 is one; of 235.507 is 2. If the number consists of a decimal only, count the number of ciphers before the first figure, and then subtract this number from 9 for the index. The index of .45 is 7; of .045 is 8; of .000045 is 5.

To find the logarithm of a natural number, If the number has only one or two places of figures in the whole part, look in the first page of logarithms, and in the column marked "No." at the top, until the required number is found; the corresponding logarithm, with its index, will be found in the first column on the right, and opposite the number. The log of 75 is 1.875061; of 99 is 1.905635.

If the number is of three figures, look in the column of numbers for it, and then under the column marked "0" at the top will be the required logarithm. The log. of 158 is 2.198657.

If the number is of four figures, find the first three in the left-hand column, and the fourth at the top of the page. Under the fourth and opposite the first three figures will be the required logarithm. The logarithm of 158.4 is 3.200029.

If the number is of more figures than four, find the log. of the first four, then multiply the difference, opposite in the column marked "Dif.," by the figures which follow the first four, point off as many places from the right as there were figures in the multiplier, add the remaining figures to the log. first found; this will give the true logarithm.

Find the log of 519468: log of first four figures is......................5.715502
The difference is 84, which, multiplied by 68, gives...................57

Log of 519468..5.715559

84
68
———
672
504
———
57.12 Cor.

Find the log of 4496345: log of first four figures is..................6.652826
Difference, 97, multiplied by 345, gives..........................33

Log of 4496345 is..6.652859

```
  345
   97
 ----
 2415
3105
-----
33.467 Cor.
```

If the number is a mixed decimal, find same as if it was a whole number, and point off for the whole part only, Log. of 51.94 is 1.715502; of 4496343, is 2.652859.

If the number is a decimal only, find the decimal part of the logarithm in the same way as if it was a whole number; then prefix the index, which is 9 less the number of ciphers before the first figure. The log. of .2641 is 9.421768; the log. of .002641 is 7.421768; the log of .00002641 is 5.421768.

To find the natural number corresponding to any logarithm:

If the index is 3, the required number will have four figures in its whole part. Look in the columns of logarithms for the decimal part of the logarithm, and find the logarithm that is nearest to the given logarithm; take the three figures in the column of numbers opposite, and the figure at the top of the column in which the logarithm lies. This will be the required number.

Find the number corresponding to log. 3.421770. Opposite to 421768 (the nearest log.) is 264, and over it is 1. The number corresponding to 3.421770 is 2641.

If the index is 4 or over, find the log. which is next less than the given log; take the three figures opposite and the one over, as the first four figures of the required number. Then take the difference between that log. nearest the given log. and the given log., annex as many ciphers as there are figures required in the number to be found, and divide by the difference opposite in the "Dif." column.

From the logarithm 5.879242 find the number corresponding. The first four figures are 7572; the difference between the given and required log. is 31; the difference from the "Dif." column is 57.

```
57)3100(54   The number, then, is 757254.
   285
   ---
    250
    228
```

If the log. is that of a decimal, such as 9.681241, find the number just as if were a whole number, 480, and point off for the index 9, the whole as a decimal; for the index 8, prefix 0 and point off the whole as a decimal.

Logs..		Numbers Corresponding.
	9.681241...........	.480
	8.681241...........	.0480
	7.681241...........	.00480
	6.681241...........	.000480

Table II.—*To find the log. sine, tangent, etc., of any arc or angle, in degrees and minutes.*

If the number of degrees is under 45, they will be found at the top of the page, and the minutes in the left-hand column of the page, marked "M." at the top and bottom; the required logarithm will be found opposite the minutes, and in the column with the name of the function that you want to find at the top. But if the number of degrees is over 45, they will be found at the bottom of the page, with the minutes in the right-hand side column of the page, marked "M." at bottom and top; opposite the minutes, and in the column with the name of the required function at the bottom, will be found the required logarithm. If it is required to find the log. co-sine of 9° 51′, look for the page marked with 9° at the top, and then down the side column for 51′; opposite to this, and in the column marked "Co-sine" at the top, will be found 9.993550, which is the log. co-sine of 9° 51′. The log. tangent of 80° 11′ is found in the same way, with the 80 degrees at the bottom of the page, the minutes in the right-hand side column, and in the column marked "Tang." at the bottom; it is 10.761880.

When the given degrees exceed 90, they are to be subtracted from 180 degrees, and the logarithm of the remainder taken out, as before. Or the logarithmic sine, tangent, etc., of an arc more than 90 is the logarithmic co-sine, co-tangent, etc., of its excess above 90 degrees.

Examples:

			Log. to 6 places.	Log. to 5 places.
Required the log. sine of........	36°	32′	97.74729	9.77473
co-sine of	61	18	9.681443	9.68144
tangent of	54	17	10.143263	10.14526
co-tangent of......	42	50	10.032877	10.03288
secant of..........	19	27	10.025519	10.02552
co-secant of.......	70	33	10.025519	10.02552
sine of..............	108	36	9.976702	9.97670
or sine of	71	24		
or co-sine of	18	36		

To find the log., sine, co-sine, secant, etc., of any arc or angle, in degrees, minutes and seconds.

Take the difference between the logs. for the given minutes and the next higher number of minutes; multiply this difference by the given number of seconds, and divide by 60; add the quotient to the log. found for degrees and minutes, in the case of sines, tangents and secants; subtract it in the case of co-sines, co-secant and co-tangent. For example.

Required the log. secant for 32° 44′ 34″.

The log. secant for 32° 44′ is	10.075103	=	10.075103
And for 32° 45′ is	10.075184	+	46
Difference	81	Correct log..	10.075149
	× 34″		
	324		
	243		
	60)275.4		
Correction	45.54		

Call the correction 46, as there is 54 over, and add it to the log. secant of 32° 44′ and the correct log. secant will be for 32° 44′ 34″ ....10.075149.

Required the log. co-sine to seconds for 81° 32′ 19″.

The co-sine for 81° 32′ is	9.168008	=	9.168008
And for 81° 33′ is	9.167159	Correction ..	269
Difference	849	Correct log..	9.167739
	× 19		
	7641		
	849		
	60)1613.1		
Correction	268.51		

To find the arc or angle, in degrees and minutes, which corresponds the nearest to any given logarithmic sine, tangent, secant, etc.:

Look in the column marked at the top or bottom with the name of the given logarithm, and find the logarithm which agrees the nearest with the given logarithm; then, if the name at the top of the column corresponds with the name of the given logarithm, take the degrees from the top of the page and the minutes (opposite the nearest logarithm) in the left-hand side column; but if the name at the bottom of the page corresponds with that of the given log., take the degrees from the bottom of the page, and the minutes (opposite the nearest logarithm) in the right-hand side column.

Required the arc corresponding to log. sine 9.595435. The nearest log. is 9.595432; the arc 23° at the top of the page, and 12′ in the left-hand side column. Log. sine 9.595435=23° 12′.

Required the arc corresponding to log. co-secant, 10.044160. The nearest logarithm in the co-secant column is 10.044151; the arc is 64°, from the bottom of the page, and 36′ from the right-hand side column. Log. co-secant 10.044161=64° 36′.

Tables III. and IV.—*Difference of latitude and departure for points and degrees.*

These tables are the same except one contains points and the other degrees. The difference of latitude and departure are in miles and tenths for distances of less than 300 miles. The courses are set down in points and degrees, at the top of the pages, if they are less than 4 pts. or 45°; but the courses are at the bottom of the pages if they are over 4 pts. or 45°. The distances are in the column marked "Dist." at the top and bottom; opposite to these distances, and to the right of them, are the difference of latitude and departure. If the courses are under 45°, the "Lat." and "Dep." are marked at the top of the columns. But if the courses are over 4 pts. or 45°, the "Lat." and "Dep." are at the bottom of the columns; that is, if the course is at the bottom, read the column from the bottom; but if the course is at the top, read the columns from the top.

TABLE V.—*Table of meridional parts.*

This table is used in solving problems by Mercator's sailing. The meridional parts are found in the columns with the degrees at the top and bottom of the pages, and the minutes at the sides. It is also used in Mercator's projections in constructing charts. The meridional part corresponding to 37° 18′ is 2415.

TABLES VI., VII., VIII.—*Refraction, dip and parallax tables.*

These are to be applied to all observed altitudes. Refraction is subtractive from the observed altitude and must be taken out for the altitude which is nearest the given one. Dip is subtractive from a fore observation and additive to a back one. It is given to 100 feet height of the eye. Parallax is always additive and must be taken out to the nearest degree.

TABLE XI.—*For reducing longitude into time, and the contrary.*

This table has been added to quicken the reduction of degrees, etc., of longitude into time, or of hours, etc., into longitude. Now suppose you want to convert 160° 20′ into time, first look in the column marked degrees until you come to 160°, then in next column on the right hand and directly opposite 160° you will see 10h:40m: which is equal in time to 160°, then in the seventh column marked minutes of degrees you will find 20 minutes, and directly opposite in the next column on the right hand you will see 1m:20s: which added to 10h:40m: will make 10h:41m:20s: in time, which is equal 160° 20′ of longitude.

Ex. 1. Required the degrees, etc., corresponding to 8h:32m:45s.

	H.	M.	S.		°	′
Longitude answering to............	8	32	45	is	128	00
Longitude answering to............			45	is		3
Hence the longitude answering to...	8	32	46	is	128	03

TABLE XII.—*For reducing the sun's declination to noon at any given meridian, and to any time at the meridian of Greenwich.*

This table contains the corrections to be applied to the sun's declination as given in the Nautical Almanac; which is computed for apparent or mean noon at Greenwich; it is to be entered with the declination for noon of the given day as found in page one or two of the Nautical Almanac, at the top, and the longitude of the place or time at Greenwich, in the side columns; corresponding to these will be found the minutes and seconds to be applied to the above declination by addition or subtraction, as directed at the head of the column table; that is, when the declination is *increasing*, the correction to be added in west longitude, but to be subtracted in east longitude, or to be added for Greenwich time; but when the declination is *decreasing* the correction is to be subtracted in west longitude but to be added in east longitude, or to be subtracted for Greenwich time. When the declination and longitude, or time at Greenwich, are not nearly found in the table, proportional parts may be used. When the given time at the meridian of Greenwich exceeds 12 hours, the correction must be taken out twice as in example three. It must be observed that this table is subject to an error of a few seconds, from the sun's unequal motion in the elliptic; but it is nevertheless in general, sufficiently exact for observations taken at sea.

Ex. 1. Required the sun's declination at apparent noon on August 17, 1877, in longitude 122° 21′ west.

		°	′	″	
Sun's declination at apparent noon by p. 1 N. A. (decreasing).....		21	09	38	N.
Correction for longitude 122° 21′ W............................	−		3	44	
Sun's declination when passing the meridian of the given place....		21	05	44	N.

Ex. 2. Required the sun's declination on June 12, 1877, at 6h:24m: apparent time at Greenwich.

		°	′	″	
Sun's dec. on June 12th at apparent noon, p. 1 N. A. (increasing)..		23	11	18	N.
Correction 6h:24m: apparent time................	+			54	
Sun's declination at Greenwich time...........................		23	12	12	N.

TABLE XIII.—*Corrections for the apparent altitudes of sun and stars.*

Enter the columns marked at the top "App. Alt.," with the apparent altitude which you have, and find the nearest arc to the one you have. Take the correction opposite. If the sun was observed, the correction is in the first column to the right of the apparent altitude, but if the altitude is that of star, the correction is in the second column to the right of the app. altitude. This correction is always subtractive, and is only the refraction and parallax combined.

TABLE XIV.—*Natural sines and co-sines.*

The degrees for the natural sine are found at the top of the page, and the minutes in the left-hand column of the page. But for the co-sines the degrees are at the bottom of the page, and the minutes in the right-hand side column. The sines are under the degrees and opposite the minutes, while the co-sines are over the degrees and opposite the minutes. The natural sine or co-sine of any number of degrees over 90° is the same as the natural sine or co-sine of its supplement, that is, 180°—the angle.

If the angle or arc is given in degrees, minutes and seconds, multiply the difference at the bottom of the column by the number of seconds, point off two places, and add or subtract the quotient, according as the natural sine or natural co-sine is increasing or decreasing.

Required the natural sine of 9° 30′ 10″. Natural sine of 9° 30′ is 165048; difference for 100″ is 478, which, multiplied by 10 and point off two places=47.80; 165048+47=165095. Natural sine of 9° 30′ 10″.

Arc corresponding to natural co-sine 032289 is 88° 9′.

Table XV.—*For finding the distance of terrestrial objects at sea.*

When the eye is elevated above the surface of the adjacent land or water, we not only see the surrounding objects more distinctly, but also see those which are more remote the higher we advance. Now, although the irregularity of the surface of the land will not admit of any one rule that will give the distance to which objects may be seen at different elevations, yet at sea, where the curvature of the water is uniform, those distances may be easily computed by means of this table, in which the distances are exhibited in nautical miles and decimal parts; answering to the height of the eye, or that of the given remote object, allowance having been made for terrestrial refraction.

Example. Being at the mast head looking out for land, and elevated 130 feet above the surface of the sea, I discovered the top of a light-house in the horizon, whose height above the level of the sea is known to be 300 feet: required my distance from the light-house.

In the table opposite 130 feet is .... 13.1 miles.
Ditto 300 .... 19.9

Sum gives the distance of the ship from the light-house.... 33.0

Table XVI.—*Equations of equal altitudes.*

Observations of the sun, taken when at equal altitudes, afford an easy and accurate method of ascertaining the time shown by a chronometer at apparent or mean noon; and from thence its error; but since the sun changes his declination during the interval between the corresponding altitudes, the middle of the times by the chronometer when they were taken, will not be that shown by it when the sun passes the meridian; and hence it becomes necessary to apply a correction, called the equation of equal altitudes, to the middle of the times, which may be easily computed as follows, by means of this Table:

1. Opposite the interval between the observations, take out the logarithms marked A and B at the head of the columns.

2. To log. A add the log. (Table I) of the seconds in the change of the sun's declination between the noons of the preceding and following days (taken from the Nautical Almanac), and the log. tangent (Table II) of the given latitude; the sum of these three logs. will be the log. (Table I) of the *first* part of the equation.

3. To log. B. add the log. of the above seconds, and the log. co-tangent of the sun's declination to the nearest minute of the given day; their sum will be the log. of the *second* part of the equation.

4. The *first* part of the equation *additive* when the declination is decreasing, and of the same name with the latitude; or increasing, and of a different name from the latitude; but *subtractive*, when the declination is increasing, and of the same name with the latitude; or decreasing, and of a different name from the latitude.

5. The *second* part of the equation is *additive* when the declination is increasing; but *subtractive* when the declination is decreasing.

Tables XVII. and XVIII.—*Log. rising and horary angle.*

Enter this table with the hours, minutes and seconds. The hours will be found at the head of the page, the minutes in the left-hand column, and the seconds at the head of the column of logarithms. In the right-hand column will be found a column of proportional parts, there being five seconds of difference between each column.

Required the log. rising corresponding to 1h: 55m: 55s.

Ans. Index 4.09762=required the log. rising of 57m: 57s.

For 57m: 55s: we have..................... 50190
For 2s: we have.......................... × 50
3.50240

Table XIX.—Required the apparent time corresponding to 8.30270. The angle corresponding this log. is 1h: 05m: 10s. Required the log. corresponding to horay angle 2h: 15m: 36s: 2h: 15m: 35s: gives 8.92928; 1s: gives 10, additive.

Log. 8.92928
+ 10
8.92938

Table XX.—*To reduce the equation of time to any time under the meridian of Greenwich.*

This table is entered with the daily variation or change of the equation of time (being the difference of the equations at the preceding and the following noons, taken from pages 1 or 2 of the month in the Nautical Almanac, when they are both additive or both subtractive, but their sum when one is subtractive and the other additive) at the top, and the Greenwich time in the left side column. The corresponding correction is then to be applied to the equation at the preceding noon, by addition or subtraction, according as the equation is increasing or decreasing. But should the equation be less than the correction at the preceding noon, the former is to be substracted from the correction, and the remainder will be the reduced equation of time, to be applied in the same way as directed in the Nautical Almanac, for the equation at the following noon. When the Greenwich time exceeds twelve hours, the correction must be taken out twice, as in second example.

Ex. 1. Required the equation of time, August 17, 1877, at 4 hours apparent time at Greenwich.

	M. S.
Equation of time at app. noon, Aug. 17, page 1, Naut. Alm......	3 49
Equation of time at app. noon, Aug. 18, page 1, Naut. Alm......	3 36
Daily change of variation (decreasing)..........................	0 13
Equation of time (as above) Aug. 17..........................	3 49
Correction to difference 13 seconds and 4 hours.................	−0 02
Reduced equation time (to be added to apparent time)...........	3 47

Hence the mean time at 4 hours apparent time at Greenwich on August 17, 1877, is 4h: 3m: 47s.

Ex. 2. Required the equation of time on September 17, 1877, at 16h: 35m: mean time at St. Helena, in longitude 5° 45′ W.

	H. M.
Mean time at St. Helena..	16 35
Longitude 5° 45′ W. in time (Table IX.)........................	+ 23 W.
Mean time at Greenwich..	16 58
	M. S.
Equation time at mean noon, Sept. 17, by page 2 N. A..........	5 40
Correction to daily variation 21s: and 12h:..10 5 Correction to daily variation 4h: 58m:...... 3 9	+ 14
Reduced equation (to be added to mean time)..................	5 54

TABLE XXI.—*Amplitude.*

This table shows a method of finding the variation of the compass by comparing the magnetic with the true amplitude. The true amplitude is taken from this table, which has the declination at the top of the pages, and the latitude at the left hand.

When the minutes of latitude or declination are over 20, the mean of the amplitude for the two nearest degrees will give the required amplitude, nearly.

Required the true amplitude in latitude 40° 31′ N., when the declination is 16°.

	° ′
True amplitude for latitude 40°, dec. 16°..............	21 05
True amplitude for latitude 41°, dec. 16°..............	21 25
	2)42 30
True amplitude..................................	21 15

Required the true amplitude in latitude 2° 50′ S., declination 10° 25′.

	° ′
True amplitude in latitude 3°, dec. 10°................	10 01
True amplitude in latitude 3°, dec. 11°................	11 01
	2)21 09
True amplitude lat. 3° S., dec. 10° 25′................	10 30

TABLES.

TABLE I.

Logarithmic Sines, Tangents, and Secants, to every Point and Quarter Point of the Compass.

Points.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	Points.
0	0.000000	10.000000	0.000000	Infinite.	10.000000	Infinite.	8
0 ¼	8.690796	9.999477	8.691319	11.308681	10.000523	11.309204	7 ¾
0 ½	8.991302	9.997904	8.993398	11.006602	10.002096	11.008698	7 ½
0 ¾	9.166520	9.995274	9.171247	10.828753	10.004726	10.833480	7 ¼
1	9.290236	9.991574	9.298662	10.701338	10.008426	10.709764	7
1 ¼	9.385571	9.986786	9.398785	10.601215	10.013214	10.614429	6 ¾
1 ½	9.462824	9.980885	9.481939	10.518061	10.019115	10.537176	6 ½
1 ¾	9.527488	9.973841	9.553647	10.446353	10.026159	10.472512	6 ¼
2	9.582840	9.965615	9.617224	10.382776	10.034385	10.417160	6
2 ¼	9.630992	9.956163	9.674829	10.325171	10.043837	10.369008	5 ¾
2 ½	9.673387	9.945430	9.727957	10.272043	10.054570	10.326613	5 ½
2 ¾	9.711050	9.933350	9.777700	10.222300	10.066650	10.288950	5 ¼
3	9.744739	9.919846	9.824893	10.175107	10.080154	10.255261	5
3 ¼	9.775027	9.904828	9.870199	10.129801	10.095172	10.224973	4 ¾
3 ½	9.802359	9.888185	9.914173	10.085827	10.111815	10.197641	4 ½
3 ¾	9.827084	9.869790	9.957295	10.042705	10.130210	10.172916	4 ¼
4	9.849485	9.849485	10.000000	10.000000	10.150515	10.150515	4
	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	

LOGARITHMS OF NUMBERS.

No. 1———100 Log. 0.000000———2.000000

No.	Log.	No.	Log.	No.	Log.	No.	Log.	No.	Log.
1	0.000000	21	1.322219	41	1.612784	61	1.785330	81	1.908485
2	0.301030	22	1.342423	42	1.623249	62	1.792392	82	1.913814
3	0.477121	23	1.361728	43	1.633468	63	1.799341	83	1.919078
4	0.602060	24	1.380211	44	1.643453	64	1.806180	84	1.924279
5	0.698970	25	1.397940	45	1.653213	65	1.812913	85	1.929419
6	0.778151	26	1.414973	47	1.662758	66	1.819544	86	1.934498
7	0.845098	27	1.431364	47	1.672098	67	1.826075	87	1.939519
8	0.903090	28	1.447158	48	1.681241	68	1.832509	88	1.944483
9	0.954243	29	1.462398	49	1.690196	69	1.838849	89	1.949390
10	1.000000	30	1.477121	50	1.698970	70	1.845098	90	1.954243
11	1.041393	31	1.491362	51	1.707570	71	1.851258	91	1.959041
12	1.079181	32	1.505150	52	1.716003	72	1.857332	92	1.963788
13	1.113943	33	1.518514	53	1.724276	73	1.863323	93	1.968483
14	1.146128	34	1.531479	54	1.732394	74	1.869232	94	1.973128
15	1.176091	35	1.544068	55	1.740363	75	1.875061	95	1.977724
16	1.204120	36	1.556302	56	1.748188	76	1.880814	96	1.982271
17	1.230449	37	1.568202	57	1.755875	77	1.886491	97	1.986772
18	1.255273	38	1.579784	58	1.763428	78	1.892095	98	1.991226
19	1.278754	39	1.591065	59	1.770852	79	1.897627	99	1.995635
20	1.301030	40	1.602060	60	1.778151	80	1.903090	100	2.000000

TABLE I.

LOGARITHMS OF NUMBERS.

No. 1000———1600 Log. 000000———204120

No.	0	1	2	3	4	5	6	7	8	9	Diff.
100	000000	000434	000868	001301	001734	002166	002598	003029	003460	003891	432
101	004321	004751	005180	005609	006038	006466	006894	007321	007748	008174	428
102	008600	009026	009451	009876	010300	010724	011147	011570	011993	012415	424
103	012837	013259	013680	014100	014520	014940	015360	015779	016197	016615	420
104	017033	017451	017868	018284	018700	019116	019532	019947	020361	020775	416
105	021189	021603	022016	022428	022841	023252	023664	024075	024486	024896	412
106	025306	025715	026124	026533	026942	027350	027757	028164	028571	028978	408
107	029384	029789	030195	030600	031004	031408	031812	032216	032619	033021	404
108	033424	033826	034227	034628	035029	035430	035830	036229	036629	037028	400
109	037426	037825	038223	038620	039017	039414	039811	040207	040602	040998	397
110	041393	041787	042182	042575	042969	043362	043755	044148	044540	044931	393
111	045323	045714	046105	046495	046885	047275	047664	048053	048442	048830	390
112	049218	049606	049993	050380	050766	051153	051538	051924	052309	052694	386
113	053078	053463	053846	054230	054613	054996	055378	055760	056142	056524	383
114	056905	057286	057666	058046	058426	058805	059185	059563	059942	060320	379
115	060698	061075	061452	061829	062206	062582	062958	063333	063709	064083	376
116	064458	064832	065206	065580	065953	066326	066699	067071	067443	067814	373
117	068186	068557	068928	069298	069668	070038	070407	070776	071145	071514	370
118	071882	072250	072617	072985	073352	073718	074085	074451	074816	075182	366
119	075547	075912	076276	076640	077004	077368	077731	078094	078457	078819	363
120	079181	079543	079904	080266	080626	080987	081347	081707	082067	082426	360
121	082785	083144	083503	083861	084219	084576	084934	085291	085647	086004	357
122	086360	086716	087071	087426	087781	088136	088490	088845	089198	089552	355
123	089905	090258	090611	090963	091315	091667	092018	092370	092721	093071	352
124	093422	093772	094122	094471	094820	095169	095518	095866	096215	096562	349
125	096910	097257	097604	097951	098297	098644	098990	099335	099681	100026	346
126	100370	100715	101059	101403	101747	102090	102434	102777	103119	103462	343
127	103804	104146	104487	104828	105169	105510	105851	106191	106531	106870	341
128	107210	107549	107888	108227	108565	108903	109241	109578	109916	110253	338
129	110590	110926	111262	111598	111934	112270	112605	112940	113275	113609	335
130	113943	114277	114611	114944	115278	115610	115943	116276	116608	116940	332
131	117271	117603	117934	118265	118595	118926	119256	119586	119915	120245	330
132	120574	120903	121231	121560	121888	122216	122543	122871	123198	123525	328
133	123852	124178	124504	124830	125156	125481	125806	126131	126456	126781	325
134	127105	127429	127752	128076	128399	128722	129045	129368	129690	130012	323
135	130334	130655	130977	131298	131619	131939	132260	132580	132900	133219	321
136	133539	133858	134177	134496	134814	135133	135451	135768	136086	136403	318
137	136721	137037	137354	137670	137987	138303	138618	138934	139249	139564	316
138	139879	140194	140508	140822	141136	141450	141763	142076	142389	142702	314
139	143015	143327	143639	143951	144263	144574	144885	145196	145507	145818	311
140	146128	146438	146748	147058	147367	147676	147985	148294	148603	148911	309
141	149219	149527	149835	150142	150449	150756	151063	151370	151676	151982	307
142	152288	152594	152900	153205	153510	153815	154119	154424	154728	155032	305
143	155336	155640	155943	156246	156549	156852	157154	157457	157759	158061	303
144	158362	158664	158965	159266	159567	159868	160168	160468	160769	161068	300
145	161368	161667	161967	162266	162564	162863	163161	163460	163757	164055	298
146	164353	164650	164947	165244	165541	165838	166134	166430	166726	167022	296
147	167317	167613	167908	168203	168497	168792	169086	169380	169674	169968	294
148	170262	170555	170848	171141	171434	171726	172019	172311	172603	172895	292
149	173186	173478	173769	174060	174351	174641	174932	175222	175512	175802	290
150	176091	176381	176670	176959	177248	177536	177825	178113	178401	178689	288
151	178977	179264	179552	179839	180126	180413	180699	180986	181272	181558	287
152	181844	182129	182415	182700	182985	183270	183554	183839	184123	184407	285
153	184691	184975	185259	185542	185825	186108	186391	186674	186956	187239	283
154	187521	187803	188084	188366	188647	188928	189209	189490	189771	190051	281
155	190332	190612	190892	191171	191451	191730	192010	192289	192567	192846	279
156	193125	193403	193681	193959	194237	194514	194792	195069	195346	195623	278
157	195900	196176	196452	196729	197005	197281	197556	197832	198107	198382	276
158	198932	198392	199206	199481	199755	200029	200303	200577	200850	201124	274
159	201397	201670	201943	202216	202488	202761	203033	203305	203577	203848	272
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 1600——2200 Log. 204120——342423

No.	0	1	2	3	4	5	6	7	8	9	Diff.
160	204120	204391	204662	204933	205204	205475	205745	206016	206286	206556	271
161	206826	207095	207365	207634	207903	208172	208441	208710	208978	209247	269
162	209515	209783	210051	210318	210586	210853	211120	211388	211654	211921	267
163	212188	212454	212720	212986	213252	213518	213783	214049	214314	214579	266
164	214844	215109	215373	215638	215902	216166	216430	216694	216957	217221	264
165	217484	217747	218010	218273	218535	218798	219060	219322	219584	219846	262
166	220108	220370	220631	220892	221153	221414	221675	221936	222196	222456	261
167	222716	222976	223236	223496	223755	224015	224274	224533	224792	225051	259
168	225309	225568	225826	226084	226342	226600	226858	227115	227372	227630	258
169	227887	228144	228400	228657	228913	229170	229426	229682	229938	230193	256
170	230449	230704	230960	231215	231470	231724	231979	232233	232488	232742	255
171	232996	233250	233504	233757	234011	234264	234517	234770	235023	235276	253
172	235528	235781	236033	236285	236537	236789	237041	237292	237544	237795	252
173	238046	138297	238548	238799	239049	239299	239550	239800	240050	240300	250
174	240549	240799	241048	241297	241546	241795	242044	242293	242541	242790	249
175	243038	243286	243534	243782	244030	244277	244524	244772	245019	245266	247
176	245513	245759	246006	246252	246499	246745	246991	247236	247482	247728	246
177	247973	248219	248464	248709	248954	249198	249443	249687	249932	250176	245
178	250420	250664	250908	251151	251395	251638	251881	252125	252367	252610	243
179	252853	253096	253338	253580	253822	254064	254306	254548	254790	255031	242
180	255273	255514	255755	255996	256236	256477	256718	256958	257198	257439	241
181	257679	257918	258158	258398	258637	258877	259116	259355	259594	259833	239
182	260071	260310	260548	260787	261025	261263	261501	261738	261976	262214	238
183	262451	262688	262925	263162	263399	263636	263873	264109	264345	264582	237
184	264818	265054	265290	265525	265761	265996	266232	266467	266702	266937	235
185	267172	267406	267641	267875	268110	268344	268578	268812	269046	269279	234
186	269513	269746	269980	270213	370446	270679	270912	271144	271377	271609	233
187	271842	272074	272306	272538	272770	273001	273233	273464	273696	273927	232
188	274158	274389	274620	274850	275081	275311	275542	275772	276002	276232	230
189	276462	276691	276921	277151	277380	277609	277838	278067	278296	278525	229
190	278754	278982	279210	279439	279667	279895	280123	280351	280578	280806	228
191	281033	281261	281488	281715	281942	282169	282395	282622	282849	283075	227
192	283301	283527	283753	283979	284205	284431	284656	284882	285107	285332	226
193	285557	285782	286007	286232	286456	286681	286905	287130	287354	287578	225
194	287802	288025	288249	288473	288696	288920	289143	289366	289589	289812	223
195	290035	290257	290480	290702	290925	291147	291369	291591	291813	292034	222
196	292256	292478	292699	292920	293141	263363	293583	293804	294025	294246	221
197	294466	294687	294907	295127	295347	295567	295787	296007	296226	296446	220
198	296665	296884	297104	297323	297542	297761	297979	298198	298416	298635	219
199	298853	299071	299289	299507	299725	299943	300161	300378	300595	300813	218
200	301030	301247	301464	301681	301898	302114	302331	302547	302764	302980	217
201	303196	303412	303628	303844	304059	304275	304491	304706	304921	305136	216
202	305351	305566	305781	305996	306211	306425	306639	306854	307068	307282	214
203	307496	307710	307924	308137	308351	308564	308778	308991	309204	309417	213
204	309630	309843	310056	310268	310481	310693	310906	311118	311330	311542	212
205	311754	311966	312177	312389	312600	312812	313023	313234	313445	313656	211
206	313867	314078	314289	314499	314710	314920	315130	315340	315550	315760	210
207	315970	316180	316390	316599	316809	317018	317227	317436	317645	317854	208
208	318063	318272	318481	318689	318898	319106	319314	319522	319730	319938	208
209	320146	320354	320562	320769	320977	321184	321391	321598	321805	322012	207
210	322219	322426	322633	322839	323046	323252	323458	323665	323871	324077	206
211	324282	324488	324694	324899	325105	325310	325516	325721	325926	326131	205
212	326336	326541	326745	326950	327155	327359	327563	327767	327972	328176	204
213	328380	328583	328787	328991	329194	329398	329601	329805	330008	330211	203
214	330414	330617	330819	331022	331255	331427	331630	331832	332034	332236	202
215	332438	332640	332842	333044	333246	333447	333649	333850	334051	334253	202
216	334454	334655	334856	335056	335257	335458	335658	335859	336059	336260	201
217	336460	336660	336860	337060	337260	337459	337659	337858	338058	338257	200
218	338456	338656	338855	339054	339253	339451	339650	339849	340047	340246	199
219	340444	340642	340841	341039	341237	341435	341632	341830	342028	342225	198
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 2200——2800 Log. 342423——447158

No.	0	1	2	3	4	5	6	7	8	9	Diff.
220	342423	342620	342817	343014	343214	343409	343606	343802	343999	344196	197
221	344392	344589	344785	344981	345178	345374	345570	345766	345962	346157	196
222	346353	346549	346744	346939	347135	347330	347522	347720	347915	348110	195
223	348305	348500	348694	348889	349083	349278	349470	349666	349860	350054	194
224	350248	350442	350636	350829	351023	351216	351410	351603	351796	351989	193
225	352182	352375	352568	352761	352954	353147	353339	353532	353724	353916	193
226	354108	354301	354493	354685	354876	355068	355260	355452	355643	355834	192
227	356026	356217	356408	356599	356790	356981	357172	357363	357554	357744	191
228	357935	358125	358316	358506	358696	358886	359076	359266	359456	359646	190
229	359835	360025	360215	360404	360593	360783	360972	361161	361350	361539	189
230	361728	361917	362105	362294	362482	362671	362859	363048	363236	363424	188
231	363612	363800	363988	364176	364363	364551	364739	364926	365113	365301	188
232	365488	365675	365862	366049	366236	366423	366610	366796	366983	367169	187
233	367356	367542	367729	367915	368101	368287	368473	368659	368844	369030	186
234	369216	369401	369587	369772	369958	370143	370328	370513	370698	370883	185
235	371068	371253	371437	371622	371806	371991	372175	372360	372544	372728	184
236	372912	373096	373280	373464	373647	373831	374015	374198	374382	374565	184
237	374748	374932	375115	375298	375481	375664	375846	376029	376213	376394	183
238	376577	376759	376942	377124	377306	377488	377670	377852	378034	378216	182
239	378398	378580	378761	378943	379124	379306	379487	379668	379849	380030	181
240	380211	380392	380573	380754	380934	381115	381296	381476	381656	381837	181
241	382017	382197	382377	382557	382737	382917	383097	383277	383456	383636	180
242	383815	383995	384174	384353	384533	384712	384891	385070	385249	385428	179
243	385606	385785	385964	386142	386321	386499	386677	386856	387034	387212	178
244	387390	387568	387746	387923	388101	388279	388456	388634	388811	388989	178
245	389166	389343	389520	389697	389875	390051	390228	390405	390582	390759	177
246	390935	391112	391288	391464	391641	391817	391993	392169	392345	392521	176
247	392697	392873	393048	393224	393400	393575	393751	393926	894101	394277	166
248	394452	394627	394802	394977	395152	395326	395501	395676	395850	396025	175
249	396199	396374	396548	396722	396896	397071	397245	397418	397592	397766	174
250	397940	398114	398287	398461	398634	398808	398981	396154	399327	399501	173
251	399674	399847	400020	400192	400365	400538	400711	400883	401056	401228	173
252	401400	401573	401745	401917	402089	402261	402433	402605	402777	402949	172
253	403120	403292	403464	403635	403807	403978	404149	404320	404492	404663	171
254	404834	405005	405175	405346	405517	405688	405858	406029	406199	406370	171
255	406540	406710	406881	407051	407221	407391	407561	407731	407900	408070	170
256	408240	408410	408579	408749	408918	409087	409257	409426	409595	409764	169
257	409933	410102	410271	410440	410608	410777	410946	411114	411283	411451	169
258	411620	411788	411956	412124	412292	412460	412628	412796	412964	413132	168
259	413300	413467	413635	413802	413970	414137	414305	414472	414639	414806	167
260	414973	415140	415307	415474	415641	415808	415974	416141	416308	416474	167
261	416640	416807	416973	417139	417306	417472	417638	417804	417970	418135	166
262	418301	418467	418633	418798	418964	419129	419295	419460	419625	319791	165
263	419956	420121	420286	420451	420616	420781	420945	421110	421275	421439	165
264	421604	421768	421933	422097	422261	422426	422590	422754	422918	423082	164
265	423246	423410	423573	423737	423901	424064	424228	424392	424555	424718	164
266	424882	425045	425208	425371	425534	425697	425860	426023	426186	426349	163
267	426511	426674	426836	426999	427161	427324	427486	427648	427811	427973	162
268	428135	428297	428459	428621	428782	428944	429106	429268	429429	429591	162
269	429752	429914	430075	430236	430398	430559	430720	430881	431042	431203	161
270	431364	431525	431685	431846	432007	432167	432328	432488	432649	432809	160
271	432969	433129	433290	423450	433610	433770	433930	434090	434249	434409	160
272	434569	434728	434888	435048	435207	435366	435526	435685	435844	436003	159
273	436163	436322	436481	436640	436798	436957	437116	437275	437433	437592	159
274	437751	437909	438067	438226	438384	438542	438700	438859	439017	439175	158
275	439333	439491	438648	429806	439964	440122	440279	440437	440594	440752	158
276	440909	441066	441224	441381	441538	441695	441852	442009	442166	442323	157
277	442480	442636	442793	442950	443106	443263	443419	443576	443732	443888	157
278	444045	444201	444357	444513	444669	444825	444981	445137	445293	445448	156
279	445604	445760	445915	446071	446226	446382	446537	446692	446848	447003	155
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 2800———3400 Log. 447158———531479

No.	0	1	2	3	4	5	6	7	8	9	Diff.
280	447158	447313	447468	447623	447778	447933	448088	448242	448397	448552	155
281	448706	448861	449015	449170	449324	449478	449633	449787	449941	450095	154
282	450249	450403	450557	450711	450865	451018	451172	451326	451479	451633	154
283	451786	451940	452093	352247	452400	452553	452706	452859	453012	453165	153
284	453318	453471	453624	453777	453930	454082	454235	454387	454540	454692	158
285	454845	454997	455149	455302	455454	455606	455758	455910	456062	456214	152
286	456366	456518	456670	456821	456973	457125	457276	457428	457579	457730	152
287	457882	458033	458184	458336	458487	458638	458789	458940	459091	459242	151
288	459392	459543	459694	459845	459995	460146	460296	460447	460597	460747	151
289	460898	461048	461198	461348	461498	461649	461799	461948	462098	462248	150
290	462398	462548	462697	462847	462997	463146	463296	463445	463594	463744	150
291	463893	464042	464191	464340	464489	464639	464787	464936	465085	465234	149
292	465383	465532	465680	465829	465977	466126	466274	466423	466571	466719	149
293	466868	467016	467164	467312	467460	467608	467756	467904	468052	468200	148
294	468347	468495	468643	468790	468938	469085	469233	469380	469527	469675	148
295	469822	469969	470116	470263	470410	470557	470704	470851	470998	471145	147
296	471292	471438	471585	471732	471878	472025	472171	472317	472464	472610	147
297	472756	472903	473049	473195	473341	473487	473633	473779	473925	474070	146
298	474216	474362	474508	474653	474799	474944	475090	475235	475381	475526	146
299	475671	475816	475962	476107	476252	476397	476542	476687	476832	476976	145
300	477121	477266	477411	477555	477700	477844	477989	478133	478278	478422	145
301	478566	478711	478855	478999	479143	479287	479431	479575	479719	479863	144
302	480007	480151	480294	480438	480582	480725	480869	481012	481156	481299	144
303	481443	481586	481729	481872	482016	482159	482302	482445	482588	482731	143
304	482874	483016	483159	483302	483445	483587	483730	483872	484015	484157	143
305	484300	484442	484584	484727	484869	485011	485153	485295	485437	485579	142
306	485721	485863	486005	486147	486289	486430	486572	486714	486855	486997	142
307	487138	487280	487421	487563	487704	487845	487986	488127	488269	488410	141
308	488551	488692	488833	488973	489114	489255	489396	489537	489677	489818	141
309	489958	490099	490239	490380	490520	490661	490801	490941	491081	491222	140
310	491362	491502	491642	491782	491922	492062	492201	492341	492481	492621	140
311	492760	492900	493040	493179	493319	493458	493597	493737	493876	494015	139
312	494155	494294	494433	494572	494711	494850	494989	495128	495267	495406	139
313	495544	495683	495822	495960	496099	496237	496376	496514	496653	496791	139
314	496930	497068	497206	497344	497482	497621	497759	497897	498035	498173	138
315	498311	498448	498586	498724	498862	498999	499137	499275	499412	499550	138
316	499687	499824	499962	500099	500236	500374	500511	500648	500785	500922	137
317	501059	501196	501333	501470	501607	501744	501880	502017	502154	502290	137
318	502427	502564	502700	502837	502973	503109	503246	503382	503518	503654	136
319	503791	503927	504063	504199	504335	504471	504607	504743	504878	505014	136
320	505150	505286	505421	505557	505692	505828	505963	506099	506234	506370	136
321	506515	506640	506775	506911	507046	507181	507316	507451	507586	507721	135
322	507856	507991	508125	508260	508395	508530	508664	508799	508933	509068	135
323	509202	509337	509471	509606	509740	509874	510008	510143	510277	510411	134
324	510545	510679	510813	510947	511081	511215	511348	511482	511616	511750	134
325	511883	512017	512150	512284	512417	512551	512684	512818	512951	513084	133
326	513218	513351	513484	513617	513750	513883	514016	514149	514282	514415	133
327	514548	514680	514813	514946	515079	515211	515344	515476	515609	515741	133
328	515874	516006	516139	516271	516403	516535	516668	516800	516932	517064	132
329	517196	517328	517460	517592	517724	517855	517987	518119	518251	518382	132
330	518514	518645	518777	518909	519040	519171	519303	519434	519565	519697	131
331	519828	519959	520090	520221	520352	520483	520614	520745	520876	521007	131
332	521138	521269	521400	521530	521661	521792	521922	522053	522183	522314	131
333	522444	522575	522705	522835	522966	523096	523226	523356	523486	523616	130
334	523746	523876	524006	524136	524266	524396	524526	524656	524785	524915	130
335	525045	525174	525304	525434	525563	525693	525822	525951	526081	526210	129
336	526339	526468	526598	526727	526856	526985	527114	527243	527372	527501	129
337	527630	527759	527888	528016	528145	528274	528402	528531	528660	528788	129
338	528917	529045	529174	529302	529430	529559	529687	529815	529943	530072	128
339	530200	530328	530456	530584	530712	530840	530968	531095	531223	531351	128
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 3400——4000 Log. 531479——602060

No.	0	1	2	3	4	5	6	7	8	9	Diff.
340	531479	531607	531734	531862	531990	532117	532245	532372	532500	532627	128
341	532745	532882	533009	533136	533263	533391	533518	533645	533772	533899	127
342	534026	534153	534280	534407	534534	534661	534787	534914	535041	535167	127
343	535294	535421	535547	535674	535800	535927	536053	536179	536306	536432	126
344	536558	536685	536811	536937	537063	537189	537315	537441	537567	537693	126
345	537819	537945	538071	538197	538322	538448	538574	538699	538825	538951	126
346	539076	539202	539327	539452	539578	539703	539829	539954	540079	540204	125
347	540329	540455	540580	540705	540830	540955	541080	541205	541330	541454	125
348	541579	541704	541829	541953	542078	542203	542327	542452	542576	542701	125
349	542825	542950	543074	543199	543323	543447	543571	543696	543820	543944	124
350	544068	544192	544316	544440	544564	544688	544812	544936	545060	545183	124
351	545307	545431	545554	545678	545802	545925	546049	546172	546296	546419	124
352	546543	546666	546789	546913	547036	547159	547282	547405	547529	547652	123
353	547775	547898	548021	548144	548266	548389	548512	548635	548758	548881	123
354	549003	549126	549249	549371	549494	549616	549739	549861	549984	550106	123
355	550228	550351	550473	550595	550717	550840	550962	551084	551206	551328	122
356	551450	551572	551694	551816	551938	552059	552181	552303	552425	552546	122
357	552668	552790	552911	553033	553154	553276	553398	553519	553640	553762	121
358	553883	554004	554126	554247	554368	554489	554610	554731	554852	554973	121
359	555094	555215	555330	555457	555578	555699	555820	555940	556061	556182	121
360	556302	556423	556544	556664	556785	556905	557026	557146	557267	557387	120
361	557507	557627	557748	557868	557988	558108	558228	558348	558469	558589	120
362	558709	558829	558948	559068	559188	559308	559428	559548	559667	559787	120
363	559907	560026	560146	560265	560385	560504	560624	560743	560863	560982	119
364	561101	561221	561340	561456	561578	561698	561817	561936	562055	562174	119
365	562293	562412	562531	562650	562769	562887	563008	563125	563244	563362	119
366	563481	563600	563718	563837	563955	564074	564192	564311	564429	564548	119
367	564666	564784	564903	565021	565139	565257	565378	565494	565612	565730	118
368	565848	565966	566084	566202	566320	566437	566555	566673	566791	566909	118
369	567026	567144	567262	567379	567497	567614	567732	567849	567967	568084	118
370	568202	568319	568436	568554	568671	568788	568905	569023	569140	569257	117
371	569374	569491	569608	569725	569842	569959	570076	570193	570309	570426	117
372	570543	570660	570776	570893	571010	571126	571243	571359	571476	571592	117
373	571709	571825	571942	572058	572174	572291	572407	572523	572639	572755	116
374	572872	572988	573104	573220	573336	573452	573568	573684	573800	573915	116
375	574031	574147	574263	574379	574494	574610	574726	574841	574957	575072	116
376	575188	575303	575419	575534	575650	575765	575880	575996	576111	576226	115
377	576341	576457	576572	576687	576802	576917	577032	577147	577262	577377	115
378	577492	577607	577721	577836	577951	578066	578181	578295	578410	578525	115
379	578639	578754	578868	578983	579097	579212	579326	579441	579555	579669	114
380	579784	579898	580012	580126	580240	580355	580469	580583	580697	580811	114
381	580925	581039	581153	581267	581381	581495	581608	581722	581836	281950	114
382	582063	582177	582291	582404	582518	582631	582745	582858	582972	583085	114
383	583199	583312	583426	583539	583652	583765	583879	583992	584105	584218	113
384	584331	584444	584557	584670	584783	584896	585009	585122	585235	585348	113
385	585461	585574	585686	585799	585912	586024	586137	586250	586362	586475	113
386	586587	586700	586812	586925	587037	587149	587262	587374	587486	587599	112
387	587711	587823	587935	588047	588160	588272	588384	588496	588608	588720	112
388	588832	588944	589056	589167	589279	589391	589503	589615	589726	589838	112
389	589950	590061	590173	590284	590396	590507	590619	590730	590842	590953	112
390	591065	591176	591287	591399	591510	591621	591732	591843	591955	592066	111
391	592177	592288	592399	592510	592621	592732	592843	592954	593064	593175	111
392	593286	593397	593508	593618	593729	593840	593950	594061	594171	594282	111
393	594393	594503	594613	594724	594834	594945	595055	595165	595276	595386	110
394	595496	595606	595717	595827	595837	596047	596157	596267	596377	596487	110
395	596597	596707	596817	596927	597037	597146	597256	597366	597476	597585	110
396	597695	597805	597914	598024	598134	598243	598353	598462	598572	598681	110
397	598790	598900	599009	599119	599228	599337	599446	599556	599665	599774	109
398	599883	599992	600101	600210	600319	600428	600537	600644	600755	600864	109
399	600973	601082	601190	601299	601408	601517	601625	601734	601843	601951	109
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 4000————4600 Log. 602060————662758

No.	0	1	2	3	4	5	6	7	8	9	Diff.
400	602060	602169	602277	602386	602494	602603	602711	602819	602928	603036	108
401	603144	603253	603361	603469	603577	603686	603794	603902	604010	604118	108
402	604226	604334	604442	604550	604658	604766	604874	604982	605089	605197	108
403	605305	605413	605521	605628	605736	605844	605951	606059	606166	606274	108
404	606381	606489	606596	606704	606811	606919	607026	607133	607241	607348	107
405	607455	607562	607669	607777	607884	607991	608098	608205	608312	608419	107
406	608526	608633	608740	608847	608954	609061	609167	609274	609381	609488	107
407	609594	609701	609808	609914	600021	610128	610234	610341	610447	610554	107
408	610660	610767	610873	610979	611086	611192	611298	611405	611511	611617	106
409	611723	611829	611936	612042	612148	612254	612360	612466	612572	612678	106
410	612784	612890	612996	613101	613207	613313	613419	613525	613630	613736	106
411	613842	613947	614053	614159	614264	614370	614475	614581	614686	614792	106
412	614897	615003	615108	615213	615319	615424	615529	615634	615740	615845	105
413	615950	616055	616160	616265	616370	616475	616580	616685	616790	616895	105
414	617000	617105	617210	617315	617420	617524	617629	617734	617839	617943	105
415	618048	618153	618257	618362	618466	618571	618675	618780	618884	618989	105
416	619093	619198	619302	619406	619511	619615	619719	619823	619928	620032	104
417	620136	620240	620344	620448	620552	620656	620760	620864	620968	621072	104
418	621176	621280	621384	621488	621592	621695	621799	621903	622007	622110	104
419	622214	622318	622421	622525	622628	622732	622835	622939	623042	623146	104
420	623249	623353	623456	623559	623663	623766	623869	623972	624076	624179	103
421	624282	624385	624488	624591	624694	624798	624901	625004	625107	625209	103
422	625312	625415	625518	625621	625724	625827	625929	626032	626135	626238	103
423	626340	626443	626546	626648	626751	626853	626956	627058	627161	627263	103
424	627366	627468	627571	627673	627775	627878	627980	628082	628184	628287	102
425	628389	628491	628593	628695	628797	628909	629002	629104	629206	629308	102
426	629410	629511	629613	629715	629817	629919	630021	630123	630224	630326	102
427	630428	630530	630631	630733	630834	630936	631038	631139	631241	631342	102
428	631444	631545	631647	631748	631849	631951	932052	632153	632255	632356	101
429	632457	632558	632660	632761	632862	632963	633064	633165	633266	633367	101
430	633468	633569	633670	633771	633872	633973	634074	634175	634276	634376	101
431	634477	634578	634679	634779	634880	634981	635081	635182	635283	635383	101
432	635484	635584	635685	635785	635886	635986	636086	636187	636287	636388	100
433	636488	636588	636688	636789	636889	636989	637089	637189	637289	637390	100
434	637490	637590	637690	637790	637890	637990	638090	638190	638289	638389	100
435	638489	638589	638689	638789	638888	638988	639088	639188	639287	639387	100
436	639486	639586	639686	639785	639885	639984	640084	640183	640283	640382	99
437	640481	640581	640680	640779	640879	640978	641077	641176	641276	641375	99
438	641474	641573	641672	641771	641870	641970	642069	642168	642267	642366	99
439	642464	642563	642662	642761	642860	642959	643058	643156	643255	643354	99
440	643453	643551	643650	643749	643847	643946	644044	644143	644242	644340	98
441	644439	644537	644635	644734	644832	644931	645029	645127	645226	645324	98
442	645422	645520	645619	645717	645815	645913	646011	646109	646208	646306	98
443	646404	646502	646600	646698	646796	646894	646991	647089	647187	647285	98
444	647383	647481	647579	647676	647774	647872	647969	648067	648165	648262	98
445	648360	648458	648555	648653	648750	648848	648945	649043	649140	649237	97
446	649335	649432	649530	649627	649724	649821	649919	650016	650113	650210	97
447	650307	650405	650502	650599	650696	650793	650890	650987	651084	651181	97
448	651278	651375	651472	651569	651666	651762	651859	651956	652053	652150	97
449	652246	652343	652440	652536	652633	652730	652826	652923	653019	653116	97
450	653213	653309	653405	653502	653598	653695	653791	653888	653984	654080	96
451	654176	654273	654369	654465	654562	654658	654754	654850	654946	655042	96
452	655138	655234	655331	655427	655523	655619	655714	655810	655906	656002	96
453	656098	656194	656290	656386	656481	656577	656673	656769	656864	656960	96
454	657056	657151	657247	657343	657438	657534	657629	657725	657820	657916	96
455	658011	658107	658202	658298	658393	658488	658584	658679	658774	658870	95
456	658965	659060	659155	659250	659346	659441	659536	659631	659726	659821	95
457	659916	660011	660106	660201	660296	660391	660486	660581	660676	660771	95
458	660865	660960	661055	661150	651245	661399	661434	661529	661623	661718	95
459	661813	661907	662002	662096	652191	662285	662380	662474	662569	662663	95
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 4600——5200 Log. 662758——716003

No.	0	1	2	3	4	5	6	7	8	9	Diff.
460	662758	662852	662947	663041	663135	663230	663324	663418	663512	663607	94
461	663701	663795	663889	663983	664078	664173	664266	664360	664454	664548	94
462	664642	664736	664830	664924	665018	665112	665206	665299	665393	665487	94
463	665581	665675	665769	665862	665956	666050	666143	666237	666331	666424	94
464	666518	666612	666705	666799	666892	666986	667079	667173	667266	667359	94
465	667453	667546	667640	667733	667826	667920	668013	668106	668199	668293	93
466	668386	668479	668572	668665	668758	668852	668945	669038	669131	669224	93
467	669317	669410	669503	669596	669689	669782	669875	669967	670060	670153	93
468	670246	670339	670431	670524	670617	670710	670802	670895	670988	671080	93
469	671173	671265	671358	671451	671543	671636	671728	671821	671913	672005	93
470	672098	672190	672283	672375	672467	672560	672652	672744	672836	672929	92
471	673021	673113	673205	673297	673390	673482	673574	673666	673758	673850	92
472	673942	674034	674126	674218	674310	674402	674494	674586	674677	674769	92
473	674861	674953	675045	675136	675228	675320	675412	675503	675595	675687	92
474	675778	675870	675962	676053	676145	676236	676328	676419	676511	676602	92
475	676694	676785	676876	676968	677059	677151	677242	677333	677424	677516	91
476	677607	677698	677789	677881	677972	678063	678154	678245	678336	678427	91
477	678518	678609	678700	678791	678882	678973	679064	679155	679246	679337	91
478	679428	679519	679610	679700	679791	679882	679973	680063	680154	680245	91
479	680335	680426	680517	680607	680698	680789	680879	680970	681060	681151	91
480	681241	681332	681422	681513	681603	681693	681784	681874	681964	682055	90
481	682145	682235	682326	682416	682506	682596	682686	682777	682867	682957	90
482	683047	683137	683227	683317	683407	683497	683587	683677	683767	683857	90
483	683947	684037	684127	684217	684307	684396	684486	684576	684666	684756	90
484	684845	684935	685025	685114	685204	685294	685383	685473	685563	685652	90
485	685742	685831	685921	686010	686100	686189	686279	686368	686457	686547	89
486	686636	686726	686815	686904	686994	687083	687172	687261	687351	687440	89
487	687529	687618	687707	687796	687886	687975	688064	688153	688242	688331	89
488	688420	688509	688598	688687	688776	688865	688953	689042	689131	689220	89
489	689309	689398	689486	689575	689664	689753	689841	689930	690019	690107	89
490	690196	680285	690373	690462	690550	690639	690727	690816	690905	690993	89
491	691081	691170	691258	691347	691435	691524	691612	691700	691789	691877	88
492	691965	692053	692142	692230	692318	692406	692494	692583	692671	692759	88
493	692847	692935	693023	693111	693199	693287	693375	693463	693551	693639	88
494	693727	693815	693903	693991	694078	694166	694254	694342	694430	694517	88
495	694605	694693	694781	694868	694956	695044	695131	695219	695307	695394	88
496	695482	695569	695657	695744	695832	695919	696007	696094	696182	696269	87
497	696356	696444	696531	696618	696706	696793	696880	696968	697055	697142	87
498	687229	697317	697404	697491	697578	697665	697752	697839	697926	698013	87
499	698100	698188	698275	698362	698448	698535	698622	698709	698796	698883	87
500	698970	699057	699144	699236	699317	699404	698491	699578	699664	690751	87
501	696838	699924	700011	700098	700184	700271	700358	700444	700531	700617	87
502	700704	700790	700877	700963	701050	701136	701222	701309	701395	701482	86
503	701568	701654	701741	701827	701913	701999	702086	702172	702258	702344	86
504	702430	702517	702603	702689	702775	702861	702947	703033	703119	703205	86
505	703291	703377	703463	703549	703635	703721	703807	703893	703979	704065	86
506	704150	704236	704322	704408	704494	704579	704665	704751	704837	704922	86
507	705008	705094	705179	705265	705350	705436	705522	705607	705693	705778	86
508	705864	705949	706035	706120	706206	706291	706376	706462	706547	706632	85
509	706718	706803	706888	706974	707059	707144	707229	707315	707400	707485	85
510	707570	707655	707740	707826	707911	707996	708081	708166	708251	708336	85
511	708421	708506	708591	708676	708761	708846	708931	709015	709100	709185	85
512	709270	709355	709440	709524	709609	709694	709779	709863	709948	710033	85
513	710117	710202	710287	710371	710456	710540	710625	710710	710794	710879	85
514	710963	711048	711132	711216	711301	711385	711470	711554	711638	711723	84
515	711807	711892	711976	712060	712144	712229	712313	712397	712481	712566	84
516	712650	712734	712818	712902	712986	713070	713154	713238	713322	713406	84
517	713490	713574	713658	713742	713826	713910	713994	714078	714162	714246	84
518	714330	714414	714497	714581	714665	714749	714832	714916	715000	715084	84
519	715167	715251	715335	715418	715502	715586	715669	715753	715836	715920	84
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 5200——5800 Log. 716003——763428

No.	0	1	2	3	4	5	6	7	8	9	Diff.
520	716003	716087	716170	716254	716337	716421	716504	716588	716671	716754	83
521	716838	716921	717004	717088	717171	717254	717338	717421	717504	717587	83
522	717671	717754	717837	717920	718003	718086	718169	718253	718336	718419	83
523	718502	718585	718668	718751	718834	718917	719000	719083	719165	719248	83
524	719331	719414	719497	719580	719663	719745	719828	719911	719994	720077	83
525	720159	720242	720325	720407	720490	720573	720655	720738	720821	720903	83
526	720986	721068	721151	721233	721316	721398	721481	721563	721646	721728	82
527	721811	721893	721975	722058	722140	722222	722305	722387	722469	722552	82
528	722634	722716	722798	722881	722963	723045	723127	723209	723291	723374	82
529	723456	723538	723620	723702	723784	723866	723948	724030	724112	724194	82
530	724276	724358	724440	724522	724603	724685	724767	724849	724931	725013	82
531	725095	725176	725258	725340	725422	725503	725585	725667	725748	725830	82
532	725912	725993	726075	726156	726238	726320	726401	726483	726564	726646	82
533	726727	726809	726890	726972	727053	727134	727216	727297	727379	727460	81
534	727541	727623	727704	727785	727866	727948	728029	728110	728191	728273	81
535	828354	728435	728516	728597	728678	728759	728841	728922	729003	729084	81
536	729165	729246	729327	729408	729489	729570	729651	729732	729813	729893	81
537	729974	730055	730136	730217	730298	730378	730459	730540	730621	730702	81
538	730782	730863	730944	731024	731105	731186	731266	731347	731428	731508	81
539	731589	731669	731750	731830	731911	731991	732072	732152	732233	732313	81
540	732394	732474	732555	732635	732715	732796	732876	732956	733037	733117	80
541	733197	733278	733358	733438	733518	733598	733679	733759	733839	733919	80
542	733999	734079	734159	734240	734320	734400	734480	734560	734640	734720	80
543	734800	734880	734960	735040	735120	735200	735279	735359	735439	735519	80
544	735599	735679	735759	735838	735918	735998	736078	736157	736237	736317	80
545	736396	736476	736556	736635	736715	736795	736874	736954	737034	737113	80
546	737193	737272	737352	737431	437511	737590	737670	737749	737829	737908	79
547	737987	738067	738146	738225	738305	738384	738463	738543	738622	638701	79
548	738781	738860	738939	739018	739097	739177	739256	739335	739414	739493	79
549	739572	739651	739730	739810	739889	739968	740047	740126	740205	740284	79
550	740363	740442	740521	740599	740678	740757	740836	740915	740994	741073	79
551	741152	741230	741309	741388	741467	741546	741624	741703	741782	741860	79
552	741939	742018	742096	742175	742254	742332	742411	742489	742568	742647	79
553	742725	742804	742882	742961	743039	743118	743196	743275	743353	743431	78
554	743510	743588	743667	743745	743823	743902	743980	744058	744136	744215	78
555	744293	744371	774449	744528	744606	744684	744740	744819	744917	744997	78
556	745075	745153	745231	745309	745387	745465	745543	745621	745699	745777	78
557	645855	745933	746011	746089	746167	746245	746323	746401	746479	746556	78
558	746634	746712	746790	746868	746945	747023	747101	747179	747256	747334	78
559	747412	747489	747567	747645	747722	747800	747878	747955	748033	748110	78
560	748188	748266	748343	748421	748498	748576	748653	748731	748808	748885	77
561	748963	749040	749118	749195	749272	749350	749427	749504	749582	749659	77
562	749736	749814	749891	749968	750045	750123	750200	750277	750354	750431	77
563	750508	750586	750663	750740	750817	750894	750971	751048	751125	751202	77
564	751279	751356	751433	751510	751587	751664	751741	751818	751895	751972	77
565	752048	752125	752202	752279	752356	752433	752509	752586	752663	752740	77
566	752816	752893	752970	753047	753123	753200	753277	753353	753430	753506	77
567	753583	753660	753736	753813	753889	753966	754042	754119	754195	754272	77
568	754348	754425	754501	754578	754654	754730	754807	754883	754960	755036	76
569	755112	755189	755265	755341	755417	755494	755570	755646	755722	755799	76
570	755875	755951	756027	756103	756180	756256	756332	756408	756484	756560	76
571	756636	756712	756788	756864	756940	757016	757092	757168	757244	757320	76
572	757396	757472	757548	757624	757700	757775	757851	757927	758003	758079	76
573	758155	758230	758306	758382	758458	758533	758609	758685	758761	758836	76
574	758912	758988	759063	759139	759214	759290	759366	759441	759517	759592	76
575	759668	759743	759819	759894	759970	760045	760121	760196	760272	760347	75
576	760422	760498	760573	760649	760724	760799	760875	760950	761025	761101	75
577	761176	761251	761326	761402	761477	761552	761627	761702	761778	761853	75
578	761928	762003	762078	762153	762228	762303	762378	762453	762529	762604	75
579	762679	762754	762829	762904	762978	763053	763128	763203	763278	763353	75
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 5800——6400 Log. 763428——806180

No.	0	1	2	3	4	5	6	7	8	9	Diff.
580	763428	763503	763578	763653	763727	763802	763877	763952	764027	764101	75
581	764176	764251	764326	764400	764475	764550	764624	764699	764774	764848	75
582	764923	764998	765072	765147	765221	765296	765370	765445	765520	765594	75
583	765669	765743	765818	765892	765966	766041	766115	766190	766264	766338	74
584	766413	766487	766562	766636	766710	766785	766859	766933	767007	767082	74
585	767156	767230	767304	767379	767453	767527	767601	767675	767749	767823	74
586	767898	767972	768046	768120	768194	768268	768342	768416	768490	768564	74
587	768638	768712	768786	768860	768934	769008	769082	769156	769230	769303	74
588	769377	769451	769525	769599	769673	769746	769820	769894	769968	770042	74
589	770115	770189	770263	770336	770410	770484	770557	770631	770705	770778	74
590	770852	770926	770999	771073	771146	771220	771293	771367	771440	771514	74
591	771587	771661	771734	771808	771881	771955	772028	772102	772175	772248	73
592	772322	772395	772468	772542	772615	772688	772762	772835	772908	772981	73
593	773055	773128	773201	773274	773348	773421	773494	773567	773640	773713	73
594	773786	773860	773933	774006	774079	774152	774215	774298	774371	774444	73
595	774517	774590	774663	774736	774809	774882	774955	775028	775100	475173	73
596	775246	775319	775392	775465	775538	775610	775683	775756	775829	775902	73
597	775974	776047	776120	776193	776265	776338	776411	776483	776556	776629	73
598	776701	776774	776846	776919	776992	777064	777137	777209	777282	777354	73
599	777427	777499	777572	777644	777717	777789	777862	777934	778006	778079	73
600	778151	778224	778296	778368	778441	778513	778585	778658	778730	778802	72
601	778874	778947	779019	779091	779163	779236	779308	779380	779452	779524	72
602	779596	779669	779741	779813	779885	779957	780029	780101	780173	780245	72
603	780317	780389	780461	780533	780605	780677	780749	780821	780893	780965	72
604	781037	781109	781181	781253	781324	781396	781468	781540	781612	781684	72
605	781755	781827	781899	781971	782042	782114	782166	782258	782329	782401	72
606	782473	782544	782616	782688	782759	782831	782902	782974	783046	783117	72
607	783189	783260	783332	783403	783475	783546	783618	783689	783761	783832	71
608	783904	783975	784046	784118	784189	784261	784332	784403	784475	784546	71
609	784617	784689	784760	784831	784902	784974	785045	785116	785187	785259	71
610	785330	785401	785472	785543	785615	785686	785757	785828	785899	785970	71
611	786041	786112	786183	786254	786325	786396	786467	786538	786609	786680	71
612	786751	786822	786893	786964	787035	787106	787177	787248	787319	787390	71
613	787460	787531	787602	787673	787744	787815	787885	787956	788027	788008	71
614	788168	788239	788310	788381	788451	788522	788593	788663	788734	788804	71
615	788875	788946	789016	789087	789157	789228	789299	789369	789440	789510	71
616	789581	789651	789722	789792	789863	789933	790004	790074	790144	790215	70
617	790285	790356	790426	790496	790567	790637	790707	790778	790848	790918	70
618	790988	791059	791129	791199	791269	791340	791410	791480	791557	791620	70
619	791691	791761	791831	791901	791971	792041	792111	792181	792252	792322	70
620	792392	792462	792532	792602	792672	792742	792812	792882	792952	793022	70
621	793092	793162	793231	793301	793371	793441	793511	793581	793651	793721	70
622	793790	793860	793930	794000	774070	794139	794209	794279	794349	794418	70
623	794488	794558	794627	794697	794767	794836	794906	774976	795045	795115	70
624	795185	795254	795324	795393	795463	795532	795602	795671	795741	795811	69
625	795880	795949	796019	796088	796158	796227	796297	796636	796436	796505	69
626	796574	796644	796713	796782	796852	796921	796990	797060	797129	797198	69
627	797268	797337	797406	797475	797545	797614	797683	797752	797821	797890	69
628	797960	798029	798098	798167	798236	798305	798374	798443	798512	798582	69
629	798651	798720	798789	798858	798927	798996	799065	799134	799203	799272	69
630	799341	799409	799478	799547	799616	799685	799754	799823	799892	799961	69
631	800029	800098	800167	800236	800305	800373	800442	800511	800580	800648	69
632	800717	800786	800854	800923	800992	801060	801129	801198	801266	801335	69
633	801404	801472	801541	801609	801678	801747	801815	801884	801952	802021	69
634	802089	802158	802226	802295	802363	802432	802500	802568	802637	802705	68
635	802774	802842	802910	802979	803047	803116	803184	803252	803321	803389	68
636	803457	803525	803594	803662	803730	803798	803867	803935	804003	804071	68
637	804139	804208	804276	804344	804412	804480	804548	804616	804685	804753	68
638	804821	804889	804957	805025	805093	805161	805229	805297	805365	805433	68
639	805501	805569	805637	805705	805773	805841	805908	805976	806044	806112	68
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 6400——7000 Log. 806180——845098

No.	0	1	2	3	4	5	6	7	8	9	Diff.
640	806180	806248	806316	806384	806451	806519	806587	806655	806723	806790	68
641	806858	806926	806994	807061	807129	807197	807264	807332	807400	807467	68
642	807535	807603	807670	807738	807806	807873	807941	808008	808076	808143	68
643	808211	808279	808346	808414	808481	808549	808616	808684	808751	808818	68
644	808886	808953	809021	809088	809156	809223	809290	809358	809425	809492	67
645	809560	809627	809694	809762	809829	809896	809964	810031	810098	810165	67
646	810233	810300	810367	810434	810501	810569	810636	810703	810770	810837	67
647	810904	810971	811038	811106	811173	811240	811307	811374	811441	811508	67
648	811575	811642	811709	811776	811843	811910	811977	812044	812111	812178	67
649	812245	812312	812378	812445	812512	812579	812646	812713	812780	812847	67
650	812913	812980	813047	813114	813181	813247	813314	813381	813448	813514	67
651	813581	813648	813714	813781	813848	813914	813981	814048	814114	814181	67
652	814248	814314	814381	814447	814514	814581	814647	814714	814780	814847	67
653	814913	814980	815046	815113	815179	815246	815312	815378	815445	815511	66
654	815578	815644	815711	815777	815843	815910	815976	816042	816109	816175	66
655	816241	816308	816374	816440	816506	816573	816639	816705	816771	816838	66
656	816904	816970	817036	817102	817169	817235	817301	817367	817433	817499	66
657	817565	817631	817698	817764	817830	817896	817962	818028	818094	818160	66
658	818226	818292	818358	818424	818490	818556	818622	818688	818754	818819	66
659	818885	818951	819017	819083	819149	819215	819281	819346	819412	819478	66
660	819544	819610	819675	819741	819807	819873	819939	820004	820070	820136	66
661	820201	820267	820333	820399	820464	820530	820595	820661	820727	820792	66
662	820858	820924	820989	821055	821120	821186	821251	821317	821382	821448	66
663	821514	821579	821644	821710	821775	821841	821906	821972	822037	822103	65
664	822168	822233	822299	822364	822430	822495	822560	822626	822691	822756	65
665	822822	822887	822952	823018	823083	823148	823213	823279	823344	823409	65
666	823474	823539	823605	823670	823735	823800	823865	823930	823996	824061	65
667	824126	824191	824256	824321	824386	824451	824516	824581	824646	824711	65
668	824776	824841	824906	824971	825036	825101	825166	825231	825296	825361	65
669	825426	825491	825556	825621	825686	825751	825815	825880	825945	826010	65
670	826075	826140	826204	826269	826334	826399	826464	826528	826593	826658	65
671	826723	826787	826852	826917	826981	827046	827111	827175	827240	827305	65
672	827369	827434	827498	827563	827628	827692	827757	827821	827886	827951	65
673	828015	828080	828144	828209	828273	828338	828402	828467	828531	828595	64
674	828660	828724	828789	828853	828918	828982	829046	829111	829175	829239	64
675	829304	829368	829432	829497	829561	829625	829690	829754	829818	829882	64
676	829947	830011	830075	830139	830204	830268	830332	830396	830460	830525	64
677	830589	830653	830717	830781	830845	830909	830973	831037	831102	831166	64
678	831230	831294	831358	831422	831486	831550	831614	831678	831742	831806	64
679	831870	831934	831998	832062	832126	832189	832253	832317	832381	832445	64
680	832509	832573	832637	832700	832764	832828	832892	832956	833020	833083	64
681	833147	833211	833275	833338	833402	833466	833530	833593	833657	833721	64
682	833784	833848	833912	833975	834039	834103	834166	834230	834293	834357	64
683	834421	834484	834548	834611	834675	834739	834802	834866	834929	834993	64
684	835056	835120	835183	835247	835310	835373	835437	835500	835564	835627	63
685	835691	835754	835817	835881	835944	836007	836071	836134	836197	836261	63
686	836324	836387	836451	836514	836577	836641	836704	836767	836830	836894	63
687	836957	837020	837083	837146	837210	837273	837336	837399	837462	837525	63
688	837588	837652	837715	837778	837841	837904	837967	838030	838093	838156	63
689	838219	838282	838345	838408	838471	838534	838597	838660	838723	838786	63
690	838849	838912	838975	839038	839101	839164	839227	839289	839352	839415	63
691	839478	839541	839604	339667	839729	839792	839855	839918	839981	840043	63
692	840106	840169	840232	840294	840357	840420	840482	840545	840608	840671	63
693	840733	840796	840859	840921	840984	841046	841109	841172	841234	841297	63
694	841359	841422	841485	841547	841610	841672	841735	841797	841860	841922	63
695	841985	842047	842110	842172	842235	842297	842360	842422	842484	842547	62
696	842609	842672	842734	842796	842859	842921	842983	843046	843108	843170	62
697	843233	843295	843357	843420	843482	843544	843606	843669	843731	843793	62
698	843855	843918	843980	844042	844104	844166	844229	844291	844353	844415	62
699	844477	844539	844601	844664	844726	844788	844850	844912	843974	845036	62
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 7000——7600 Log. 845098——880814

No.	0	1	2	3	4	5	6	7	8	9	Diff.
700	845098	845160	845222	845284	845346	845408	845470	845532	845594	845656	62
701	845718	845780	845842	845904	845966	846028	846090	846151	846213	846275	62
702	846337	846399	846461	846523	846584	846646	846708	846770	846832	846894	62
703	846955	847017	847079	847141	847202	847264	847326	847388	847449	847511	62
704	847573	847634	847696	847758	847819	847881	847943	848004	848066	848127	62
705	848189	848251	848312	848374	848435	848497	848559	858620	848682	848743	62
706	848805	848866	848928	848989	849051	849112	849174	849235	849296	849358	61
707	849419	849481	849542	849604	849665	849726	849788	849849	849911	849972	61
708	850033	850095	850156	850217	850279	850340	850401	850462	850524	850585	61
709	850646	850707	850769	850830	850891	850952	851014	851075	851136	851197	61
710	851258	851320	851381	851442	851503	851564	851625	851686	851747	851808	61
711	851870	851931	851992	852053	852114	852175	852236	852297	852358	852419	61
712	852480	852541	852602	852663	852724	852785	852846	852907	852968	853029	61
713	853090	853150	853211	853272	853333	853394	853455	853516	853576	853637	61
714	853698	853759	853820	853881	853941	854002	854063	854124	854185	854245	61
715	854306	854367	854427	854488	854549	854610	854670	854731	854792	854852	61
716	854913	854974	855034	855095	855156	855216	855277	855337	855398	855459	61
717	855519	855580	855640	855701	855761	855822	855882	855943	856003	856064	61
718	856124	856185	856245	856306	856366	856427	856487	856548	856608	856668	60
719	856729	856789	856850	856910	856970	857031	857091	857151	857212	857272	60
720	857332	857393	857453	857513	857574	857634	857694	857754	857815	857875	60
721	857935	857995	858056	858116	858176	858236	858297	858357	958417	858477	60
722	858537	858597	858657	858718	858778	858838	858898	858958	859018	859078	60
723	859138	859198	859258	859318	859378	859438	859499	859559	859619	859679	60
724	859739	859799	859858	859918	859978	860038	860098	860158	860218	860278	60
725	860338	860398	860458	860518	860578	860637	860697	860757	860817	860877	60
726	860937	860996	861056	861116	861176	861236	861295	861355	861415	861475	60
727	861534	861594	861654	861714	861773	861833	861893	761952	862012	862072	60
728	862131	862191	862251	862310	862370	862430	862489	862549	862608	862668	60
729	862728	862787	862847	862906	862966	863025	863085	863144	873204	863263	60
730	863323	863382	863442	863501	863561	863620	863680	863739	863798	863858	59
731	863917	863977	864036	864096	864155	864214	864274	864333	864392	864452	59
732	864511	864570	864630	864689	864748	864808	864867	864926	864985	865045	59
733	865104	865163	865222	865282	865341	865400	865459	865518	865578	865637	59
734	865696	865755	865814	865874	865933	865992	866051	866110	866169	866228	59
735	866287	866346	866405	866465	866524	866583	866642	866701	866760	866819	59
736	866878	866937	866996	867055	867114	867173	867232	867291	867350	867409	59
737	867467	867526	867585	867644	867703	867762	867821	867880	867939	867998	59
738	868056	868115	868174	868233	868292	868350	868409	868468	868527	868586	59
739	868644	868703	868762	868821	868879	868938	868997	869056	869114	869173	59
740	869232	869290	869349	869408	869466	869525	869584	869642	869701	869760	59
741	869818	869877	869935	869994	870053	870111	870170	870228	870287	870345	59
742	870404	870462	870521	870579	870638	870696	870755	870813	870872	870930	58
743	870989	871047	871106	871164	871223	871281	871339	871398	871456	871515	58
744	871573	871631	871690	871748	871806	871865	871923	871981	872040	872098	58
745	872156	872215	872273	872331	872389	872448	872506	872564	872622	872681	58
746	872739	872797	872855	872913	872972	873030	873088	873146	873204	873262	58
747	873321	873379	873437	873495	873553	873611	873669	873727	873785	873844	58
748	873902	873960	874018	874076	874134	874192	874250	874308	874366	874424	58
749	874482	874540	874598	874656	874714	874772	874830	874887	874945	875003	58
750	875061	875119	875177	875235	875293	875351	875409	875466	875524	875582	58
751	875640	875698	875756	875813	875871	875929	875987	876045	876102	876160	58
752	876218	876276	876333	876391	876449	876507	876564	876622	876680	876737	58
753	876795	876853	876910	876968	877026	877083	877141	877198	877256	877314	58
754	877371	877429	877486	877544	877602	877659	877717	877774	877832	877889	58
755	877947	878004	878062	878119	878177	878234	878292	878349	878407	878464	57
756	878522	878579	878637	878694	878751	878809	878866	878924	878981	879038	57
757	879096	879153	879211	879268	879325	879383	879440	879497	879555	879612	57
758	879669	879726	879784	879841	879898	879956	880013	880070	880127	880185	57
759	880242	880299	880356	880413	880471	880528	880585	880642	880699	880756	57
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 7600———8200 Log. 880814———913814

No.	0	1	2	3	4	5	6	7	8	9	Diff.
760	880814	880871	880928	880985	881042	881099	881156	881213	881270	881328	57
761	881385	881442	881499	881556	881613	881670	881727	881784	881841	881898	57
762	881955	882012	882069	882126	882183	882240	882997	882354	882411	882468	57
763	882524	882581	882638	882695	882752	882809	882866	882923	882980	883037	57
764	883093	883150	883207	883264	883321	883377	883434	883491	883548	883605	57
765	883661	883718	883775	883832	883888	883945	884002	884059	884115	894172	57
766	884229	884285	884342	884399	884455	884512	884569	884625	884682	884739	57
· 767	884795	884852	884909	884965	885022	885078	885135	885192	885248	885305	57
768	885361	885418	885474	885531	885587	885644	885700	885757	885813	885870	57
769	885926	885983	886039	886096	886152	886209	886265	886321	886378	886434	56
770	886491	886547	886604	886660	886716	886773	886829	886885	886942	886998	56
771	887054	887111	887167	887223	887280	887336	887392	887449	887505	887561	56
772	887617	887674	887730	887786	887842	887898	887955	888011	888067	888123	56
773	888179	888236	888292	888348	888404	888460	888516	888573	888629	888685	56
774	888741	888797	888853	888909	888965	889021	889077	889134	889190	889246	56
775	889302	889358	889414	889470	889526	889582	889638	889694	889750	889806	56
776	889362	889918	889974	890030	890086	890141	890197	890253	890309	890365	56
777	890421	890477	890533	890589	890644	890700	890756	890812	890868	890924	56
778	890980	891035	891091	891147	891203	891259	891314	891370	891426	891482	56
779	891537	891593	891649	891705	891760	891816	891872	891928	891983	892039	56
780	892095	892150	892206	892262	892317	892373	892429	892484	892540	892595	56
781	892651	892707	892762	892818	892873	892929	892985	893040	893096	893151	56
782	893207	893262	893318	893373	893429	893484	893540	893595	893651	893706	56
783	893762	893817	893873	893928	893984	894039	894094	894150	894250	894261	55
784	894316	894371	894427	874482	894538	894593	894648	894704	894759	894814	55
785	894870	894925	894980	895036	895091	895146	895201	895257	895312	895367	55
786	894423	895478	895533	895588	895643	895699	895754	895809	895864	895920	55
787	895975	896030	896085	896140	896195	896251	896306	896361	896416	896471	55
788	896526	896581	896636	896692	896747	896802	896857	896912	896967	897022	55
789	897077	897132	897187	897242	897297	897352	897407	897462	897517	897572	55
790	897627	897682	897737	897792	897847	897902	897957	898012	898067	898122	55
791	898176	898231	898286	898341	898396	898451	898506	898561	898615	898670	55
792	898725	898780	898835	898890	898944	898999	899054	899109	899164	899218	55
793	899273	899328	899383	899437	899492	899547	899602	899656	899711	899766	55
794	899820	899875	899930	899985	900039	900094	900149	900203	900258	900312	55
795	900367	900422	900476	900531	900586	900640	900695	900749	900804	900858	55
796	900913	900968	901022	901077	901131	901186	901240	901295	901349	901404	55
797	901458	901513	901567	901622	901676	901731	901785	901840	901894	901948	54
798	902003	902057	902112	902166	902221	902275	902329	902384	902438	902491	54
799	902547	902601	902655	902710	902764	902818	902873	902927	902981	903036	54
800	903090	903144	903198	903253	903307	903361	903416	903470	903524	903578	54
801	903632	903687	903741	903795	903849	903903	903958	904012	904066	904120	54
802	904174	904228	904283	904337	904391	904445	904499	904553	904607	904661	54
803	904715	904770	904824	904878	904932	904986	905040	905094	905148	905202	54
804	905256	905310	905364	905418	905472	905526	905580	905634	905688	905742	54
805	905796	905850	905904	905958	906012	906065	906119	906173	906227	906281	54
806	906335	906389	906443	906497	906550	906604	906658	906712	906766	906820	54
807	906873	906927	906981	907035	907089	907142	907196	907250	907304	907358	54
808	907411	907465	907519	907573	907626	907680	907734	907787	907841	907895	54
809	907948	908002	908056	908109	908163	908217	908270	908324	908378	908431	54
810	908485	908539	908592	908646	908699	908753	908807	908860	908914	908967	54
811	909021	909074	909128	909181	909235	909288	909342	909395	909449	909502	54
812	909556	909609	909663	909716	909770	909823	909877	909930	909984	910037	53
813	910090	910144	910197	910251	910304	910358	910411	910464	910518	910571	53
814	910624	910678	910731	910784	910838	910891	910944	910998	911051	911104	53
815	911158	911211	911264	911317	911371	911424	911477	911530	911584	911637	53
816	911690	911743	911797	911850	911903	911956	912009	912063	912116	912169	53
817	912222	912275	912328	912381	912435	912488	912541	912494	912647	912700	53
818	912753	912806	912859	912913	912966	913019	913072	913125	913178	913231	53
819	913284	913337	913390	913143	913496	913549	913602	913655	913708	913761	53
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 8200——8800 Log. 913814——944483

No.	0	1	2	3	4	5	6	7	8	9	Diff.
820	913814	913867	913920	913973	914026	914079	914131	914184	914237	914290	53
821	914343	914396	914449	914502	914555	914608	914660	914713	914766	914819	53
822	914872	914925	914977	915030	915083	915136	915189	915241	915294	915347	53
823	915400	915453	915505	915558	915611	915664	915716	915769	915822	915874	53
824	915927	915980	916033	916085	916138	916191	916243	916296	916349	916401	53
825	916454	916507	916559	916612	916664	916717	916770	916822	916875	916927	53
826	916980	917033	917085	917138	917190	917243	917295	917348	917400	917453	53
827	917505	917558	917610	917663	917715	917768	917820	917873	917925	917978	52
828	918030	918083	918135	918188	918240	918292	918345	918397	918450	918502	52
829	918555	918607	918659	918712	918764	918816	918869	918921	918973	919026	52
830	919078	919130	919183	919235	919287	919340	919392	919444	919496	919549	52
831	919601	919653	919705	919758	919810	919862	919914	919967	920019	920071	52
832	920123	920175	920228	920280	920332	920384	920436	920489	920541	920593	52
833	920645	920697	920749	920801	920853	920906	920958	921010	921062	921114	52
834	921166	921218	921270	921322	921374	921426	921478	921530	921582	921634	52
835	921686	921738	921790	921842	921894	921946	921998	922050	922102	922154	52
836	922206	922258	922310	922362	922414	922466	922518	922570	922622	922674	52
837	922725	922777	922829	922881	922933	922985	923037	923088	923140	923192	52
838	923244	923296	923348	923399	923451	923503	923555	923607	923658	923710	52
839	923762	923814	923865	923917	923969	924021	924072	924124	924176	924228	52
840	924279	924331	924383	924434	924486	924538	924589	924641	924693	924744	52
841	924796	924848	924899	924951	925002	925054	925106	925157	925209	925260	52
842	925312	925364	925415	925467	925518	925570	925621	925673	925724	925776	52
843	925828	925879	925931	925982	926034	926085	926137	926188	926239	926291	51
844	926342	926394	926445	926497	926548	926600	926651	926702	926754	926805	51
845	926857	926908	926959	927011	927062	927114	927165	927216	927268	927319	51
846	927370	927422	927473	927524	927576	927627	927678	927730	927781	927832	51
847	927883	927935	927986	928037	928088	928140	928191	928242	928293	928345	51
848	928396	928447	928498	928549	928601	928652	928703	928754	928805	928856	51
849	928908	928959	929010	929061	929112	929163	929214	929266	929317	929368	51
850	929419	929470	929521	929572	929623	929674	929725	929776	929827	929878	51
851	929930	929981	930032	930083	930134	930185	930236	930287	930338	930389	51
852	930440	930491	930541	930592	930643	930694	930745	930796	930847	930898	51
853	930949	931000	931051	931102	931153	931203	931254	931305	931356	931407	51
854	931458	931509	931560	931610	931661	931712	931763	931814	931864	931915	51
855	931966	932017	932068	932118	932169	932220	932271	932321	932372	932423	51
856	932474	932524	932575	932626	932677	932727	932778	932829	932879	932930	51
857	932981	933031	933082	933133	933183	933234	933285	933335	933386	933437	51
858	933487	933538	933588	933639	933690	933740	933791	933841	933892	933943	51
859	933993	934044	934094	934145	934195	934246	934296	934347	934397	934448	51
860	934498	934549	934599	934650	934700	934751	934801	934852	934902	934953	50
861	935003	935054	935104	935154	935205	935255	935306	935356	935406	935457	50
862	935507	935558	935608	935658	935709	935759	935809	935860	935910	935960	50
863	936011	936061	936111	936162	936212	936262	936313	936363	936413	936463	50
864	936514	936564	936614	936664	936715	936765	936815	936865	936916	936966	50
865	937016	937066	937116	937167	937217	937267	937317	937367	937418	937468	50
866	937518	937568	937618	937668	937718	937769	937819	937869	937919	937969	50
867	938019	938069	938119	938169	938219	938269	938319	938370	938420	938470	50
868	938520	938570	938620	938670	938720	938770	938820	938870	938920	938970	50
869	939020	939070	939120	939170	939220	939270	939319	939369	939419	939469	50
870	939519	939569	939619	939669	939719	939769	939819	939868	939918	939968	50
871	940018	940068	940118	940168	940218	940267	940317	940367	940417	940467	50
872.	940516	940566	940616	940666	940716	940765	940815	940865	940915	940964	50
873	941014	941064	941114	941163	941213	941263	941313	941362	941412	941462	50
874	941511	941561	941611	941660	941710	941760	941809	941859	941909	941958	50
875	942008	942058	942107	942157	942206	942256	942306	942355	942405	942454	50
876	942504	942554	942603	942653	942702	942752	942801	942851	942900	942950	50
877	943000	943049	943099	943148	943198	943247	943297	943346	943396	943445	49
878	943494	943544	943593	943643	943692	943742	943791	943841	943890	943939	49
879	943989	944038	944088	944137	944186	944236	944285	944335	944384	944433	49
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 8800——9400 Log. 944483——973128

No.	0	1	2	3	4	5	6	7	8	9	Diff.
880	944483	944532	944581	944631	944680	944729	944779	944828	944877	944927	49
881	944976	945025	945074	945124	945173	945222	945272	945321	945370	945419	49
882	945469	945518	945567	945616	945665	945715	945764	945813	945862	945911	49
883	945961	946010	946059	946108	946157	946207	946256	946305	946354	946403	49
884	946452	946501	946550	946600	946649	946698	946747	946796	946845	946894	49
885	946943	946992	947041	947090	947139	947189	947238	947287	947336	947385	49
886	947434	947483	947532	947581	947630	947679	947728	947777	947826	947875	49
887	947924	947973	948021	948070	948119	948168	948217	948266	948315	948364	49
888	948413	948462	948511	948560	948608	948657	948706	948755	948804	948853	49
889	948902	948951	948999	949048	949097	949146	949195	949244	949292	949341	49
890	949390	949439	949488	949536	949585	949634	949683	949731	949780	949829	49
891	949878	949926	949975	950024	950073	950121	950170	950219	950267	950316	49
892	950365	950413	950462	950511	950560	950608	950657	950705	950754	950803	49
893	950851	950900	950949	950997	951046	951095	951143	951192	951240	951289	49
894	951337	951386	951435	951483	951532	951580	951629	951677	951726	951774	49
895	951823	951872	951920	951969	952017	952066	952114	952163	952211	952259	48
896	952308	952356	952405	952453	952502	952550	952599	952647	952696	952744	48
897	952792	952841	952889	952938	952986	953034	953083	953131	953180	953228	48
898	953276	953325	953373	953421	953470	953518	953566	953615	953663	953711	48
899	953760	953808	953856	953905	953953	954001	954049	954098	954146	954194	48
900	954242	954291	954339	954387	954435	954484	954532	954580	954628	954677	48
901	954725	954773	954821	954869	954918	954966	955014	955062	955110	955158	48
902	955206	955255	955303	955351	955399	955447	955495	955543	955592	955640	48
903	955688	955736	955784	955832	955880	955928	955976	956024	956072	956120	48
904	956168	956216	956264	956312	956361	956409	956457	956505	956553	956601	48
905	956649	956697	956745	956792	956840	956888	956936	956984	957032	957080	48
906	957128	957176	957224	957272	957320	957368	957416	957464	957511	957559	48
907	957607	957655	957703	957751	957799	957847	957894	957942	957990	958038	48
908	958086	958134	958181	958229	958277	958325	958373	958420	958468	958516	48
909	958564	958612	958659	958707	958755	958803	958850	958898	958946	958994	48
910	959041	959089	959137	959184	959232	959280	959328	959375	959423	959471	48
911	959518	959566	959614	959661	959709	959757	959804	959852	959900	959947	48
912	959995	960042	960090	960138	960185	960233	960281	960328	960376	960423	48
913	960471	960518	960566	960613	960661	960709	960756	960804	960851	960899	48
914	960946	960994	961041	961089	961136	961184	961231	961279	961326	961374	48
915	961421	961469	961516	961563	961611	961658	961706	961753	961801	961848	47
916	961895	961943	961990	962038	962085	962132	962180	962227	962275	962322	47
917	962369	962417	962464	962511	962559	962606	962653	962701	962748	962795	47
918	962843	962890	962937	962985	963032	963079	963126	963174	963221	963268	47
919	963315	963363	963410	963457	963504	963552	963599	963646	963693	963741	47
920	963788	963835	963882	963929	963977	964024	964071	964118	964165	964212	47
921	964260	964307	964354	964401	964448	964495	964542	964590	964637	964684	47
922	964731	964778	964825	964872	964919	964966	965013	965060	965108	965155	47
923	965202	965249	965296	965343	965390	965437	965484	965531	965578	965625	47
924	965672	965719	965766	965813	965860	965907	965954	966001	966048	966095	47
925	966142	966189	966236	966283	966329	966376	966423	966470	966517	966564	47
926	966611	966658	966705	966752	966798	966845	966892	966939	966986	967033	47
927	967080	967127	967173	967220	967267	967314	967361	967408	967454	967501	47
928	967548	967595	967642	967688	967735	967782	967829	967875	967922	967969	47
929	968016	968062	968109	968156	968203	968249	968296	968343	968389	968436	47
930	968483	968530	968576	968623	968670	968716	968763	968810	968856	968903	47
931	968950	968996	969043	969090	969136	969183	969229	969276	969323	969369	47
932	969416	969462	969509	969556	969602	969649	969695	969742	969788	969835	47
933	969882	969928	969975	970021	970068	970114	970161	970207	970254	970300	47
934	970347	970393	970440	970486	970533	970579	970626	970672	970719	970765	47
935	970812	970858	970904	970951	970997	971044	971090	971137	971183	971229	46
936	971276	971322	971369	971415	971461	971508	971554	971600	971647	971693	46
937	971740	971786	971832	971879	971925	971971	972018	972064	972110	972156	46
938	972203	972249	972295	972342	972388	972434	972480	972527	972573	972619	46
939	972666	972712	972758	972804	972851	972897	972943	972989	973035	973082	46
	0	1	2	3	4	5	6	7	8	9	

TABLE I.

LOGARITHMS OF NUMBERS.

No. 9400———10000 Log. 973128———000000

No.	0	1	2	3	4	5	6	7	8	9	Diff.
940	973128	973174	973220	973266	973313	973359	973405	973451	973497	973543	46
941	973590	973636	973682	973728	973774	973820	973866	973913	973959	974005	46
942	974051	974097	974143	974189	974235	974281	974327	974373	974420	974466	46
943	974512	974558	974604	974650	974696	974742	974788	974834	974880	974926	46
944	974972	975018	975064	975110	975156	975202	975248	975294	975340	975386	46
945	975432	975478	975524	975570	975616	975661	975707	975753	975799	975845	46
946	975891	975937	975983	976029	976075	976121	976166	976212	976258	976304	46
947	976350	976396	976442	976487	976533	976579	976625	976671	976717	976762	46
948	976808	976854	976900	976946	976991	977037	977083	977129	977175	977220	46
949	977266	977312	977358	977403	977449	977495	977541	977586	977632	977678	46
950	977724	977769	977815	977861	977906	977952	977998	978043	978089	978135	46
951	978180	978226	978272	978317	978363	978409	978454	978500	978546	978591	46
952	978637	978683	978728	978774	978819	978865	978911	978956	979002	979047	46
953	979093	979138	979184	979230	979275	979321	979366	979412	979457	979503	46
954	979548	979594	979639	979685	979730	979776	979821	979867	979912	979958	46
955	980003	980049	980094	980140	980185	980231	980276	980322	980367	980412	45
956	980458	980503	980549	980594	980640	980685	980730	980776	980821	980867	45
957	980912	980957	981003	981048	981093	981139	981184	981229	981275	981320	45
958	981365	981411	981456	981501	981547	981592	981637	981683	981728	981773	45
959	981819	981864	981909	981954	982000	982045	982090	982135	982181	982226	45
960	982271	982316	982362	982407	982452	982497	982543	982588	982633	982678	45
961	982723	982769	982814	982859	982904	982949	982994	983040	983085	983130	45
962	983175	983220	983265	983310	983356	983401	983446	983491	983536	983581	45
963	983626	983671	983716	983762	983807	983852	983897	983942	983987	984032	45
964	984077	984122	984167	984212	984257	984302	984347	984392	984437	984482	45
965	984527	984572	984617	984662	984707	984752	984797	984842	984887	984932	45
966	984977	985022	985067	985112	985157	985202	985247	985292	985337	985382	45
967	985426	985471	985516	985561	985606	985651	985696	985741	985786	985830	45
968	985875	985920	985965	986010	986055	986100	986144	986189	986234	986279	45
969	986324	986369	986413	986458	986503	986548	986593	986637	986682	986727	45
970	986772	986816	986861	986906	986951	986995	987040	987085	987130	987174	45
971	987219	987264	987309	987353	987398	987443	987487	987532	987577	987622	45
972	987666	987711	987756	987800	987845	987890	987934	987979	988024	988068	45
973	988113	988157	988202	988247	988291	988336	988381	988425	988470	988514	45
974	988559	988603	988648	988693	988737	988782	988826	988871	988915	988960	45
975	989005	989049	989094	989138	989183	989227	989272	989316	989361	989405	45
976	989450	989494	989539	989583	989628	989672	989717	989761	989806	989850	44
977	989895	989939	989983	990028	990072	990117	990161	990206	990250	990294	44
978	990339	990383	990428	990472	990516	990561	990605	990650	990694	990738	44
979	990783	990827	990871	990916	990960	991004	991049	991093	991137	991182	44
980	991226	991270	991315	991359	991403	991448	991492	991536	991580	991625	44
981	991669	991713	991757	991802	991846	991890	991934	991979	992023	992067	44
982	992111	992156	992200	992244	992288	992333	992377	992421	992465	992509	44
983	992553	992598	992642	992686	992730	992774	992818	992863	992907	992951	44
984	992995	993039	993083	993127	993172	993216	993260	993304	993348	993392	44
985	993436	993480	993524	993568	993613	993657	993701	993745	993789	993833	44
986	993877	993921	993965	994009	994053	994097	994141	994185	994229	994273	44
987	994317	994361	994405	994449	994493	994537	994581	994625	994669	994713	44
988	994757	994801	994845	994889	994933	994977	995021	995064	995108	995152	44
989	995196	995240	995284	995328	985372	995416	995460	995504	995547	995591	44
990	995635	995679	995723	995767	995811	995854	995898	995942	995986	996030	44
991	996074	996117	996161	996205	996249	996293	996336	996380	996424	996468	44
992	996512	996555	996599	996643	996687	996730	996774	996818	996862	996905	44
993	996949	996993	997037	997080	997124	997168	997212	997255	997299	997343	44
994	997386	997430	997474	997517	997561	997605	997648	997692	997736	997779	44
995	997823	997867	997910	997954	997998	998041	998085	998128	998172	998216	44
996	998259	998303	998346	998390	998434	998477	998521	998564	998608	998652	44
997	998695	998739	998782	998826	998869	998913	998956	999000	999043	999087	44
998	999130	999174	999218	999261	999305	999348	999392	999435	999478	999522	44
999	999565	999609	999652	999696	999739	999783	999826	999870	999913	999957	43
	0	1	2	3	4	5	6	7	8	9	

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

0 Degree.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	0.000000	10.000000	0.000000	Infinite.	10.000000	Infinite.	60
1	6.463726	10.000000	6.463726	13.536274	10.000000	13.536274	59
2	6.764756	10.000000	6.764756	13.235244	10.000000	13.235244	58
3	6.940847	10.000000	6.940847	13.059153	10.000000	13.059153	57
4	7.065786	10.000000	7.065786	12.934214	10.000000	12.934214	56
5	7.162696	10.000000	7.162696	12.837304	10.000000	12.837304	55
6	7.241877	9.999999	7.241878	12.758122	10.000001	12.758123	54
7	7.308824	9.999999	7.308825	12.691175	10.000001	12.691176	53
8	7.366816	9.999999	7.366817	12.633183	10.000001	12.633184	52
9	7.417968	9.999999	7.417970	12.582030	10.000001	12.582032	51
10	7.463726	9.999998	7.463727	12.536273	10.000002	12.536274	50
11	7.505118	9.999998	7.505120	12.494880	10.000002	12.494882	49
12	7.542906	9.999997	7.542909	12.457091	10.000003	12.457094	48
13	7.577668	9.999997	7.577672	12.422328	10.000003	12.422332	47
14	7.609853	9.999996	7.609857	12.390143	10.000004	12.390147	46
15	7.639816	9.999996	7.639820	12.360180	10.000004	12.360184	45
16	7.667845	9.999995	7.667849	12.332151	10.000005	12.332155	44
17	7.694173	9.999995	7.694179	12.305821	10.000005	12.305827	43
18	7.718997	9.999994	7.719003	12.280997	10.000006	12.281003	42
19	7.742478	9.999993	7.742484	12.257516	10.000007	12.257522	41
20	7.764754	9.999993	7.764761	12.235239	10.000007	12.235246	40
21	7.785943	9.999992	7.785951	12.214049	10.000008	12.214057	39
22	7.806146	9.999991	7.806155	12.193845	10.000009	12.193854	38
23	7.825451	9.999990	7.825460	12.174540	10.000010	12.174549	37
24	7.843934	9.999989	7.843944	12.156056	10.000011	12.156066	36
25	7.861662	9.999989	7.861674	12.138326	10.000011	12.138338	35
26	7.878695	9.999988	7.878708	12.121292	10.000012	12.121305	34
27	7.895085	9.999987	7.895099	12.104901	10.000013	12.104915	33
28	7.910879	9.999986	7.910894	12.089106	10.000014	12.089121	32
29	7.926119	9.999985	7.926134	12.073866	10.000015	12.073881	31
30	7.940842	9.999983	7.940858	12.059142	10.000017	12.059158	30
31	7.955082	9.999982	7.955100	12.044900	10.000018	12.044918	29
32	7.968870	9.999981	7.968889	12.031111	10.000019	12.031130	28
33	7.982233	9.999980	7.082253	12.017747	10.000020	12.017767	27
34	7.995198	9.999979	7.995219	12.004781	10.000021	12.004802	26
35	8.007787	3.999977	8.007809	11.992191	40.000023	11.992213	25
36	8.020021	9.999976	8.020045	11.979955	10.000024	11.979979	24
37	8.031919	9.999975	8.031945	11.968055	10.000025	11.968081	23
38	8.043501	9.999973	8.043527	11.956473	10.000027	11.956499	22
39	8.054781	9.999972	8.054809	11.945191	10.000028	11.945219	21
40	8.065776	9.999971	8.065806	11.934194	10.000029	11.934224	20
41	8.076500	9.999969	8.076531	11.923469	10.000031	11.923500	19
42	8.086965	9.999968	8.086997	11.913003	10.000032	11.913035	18
43	8.097183	9.999966	8.097217	11.902783	10.000034	11.902817	17
44	8.107167	9.999964	8.107202	11.892798	10.000036	11.892833	16
45	8.116926	9.999963	8.116963	11.883037	10.000037	11.883074	15
46	8.126471	9.999961	8.126510	11.873490	10.000039	11.873529	14
47	8.135810	9.999959	8.135851	11.864149	10.000041	11.864190	13
48	8.144953	9.999958	8.144996	11.855004	10.000042	11.855047	12
49	8.153907	9.999956	8.153952	11.846048	10.000044	11.846093	11
50	8.162681	9.999954	8.162727	11.837273	10.000046	11.837319	10
51	8.171280	9.999952	8.171328	11.828672	10.000048	11.828720	9
52	8.179713	9.999950	8.179763	11.820237	10.000050	11.820287	8
53	8.187985	9.999948	8.188036	11.811964	10.000052	11.812015	7
54	8.196102	9.999946	8.196156	11.803844	10.000054	11.803898	6
55	8.204070	9.999944	8.204126	11.795874	10.000056	11.795930	5
56	8.211895	9.999942	8.211953	11.788047	10.000058	11.788105	4
57	8.219581	9.999940	8.219641	11.780359	10.000060	11.780419	3
58	8.227134	9.999938	8.227195	11.772805	10.000062	11.772866	2
59	8.234557	9.999936	8.234621	11.765379	10.000064	11.765443	1
60	8.241855	9.999934	8.241922	11.758078	10.000066	11.758145	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

89 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

1 Degree.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	8.241855	9.999934	8.241921	11.758079	10.000066	11.758145	60
1	8.249033	9.999932	8.249102	11 750898	10.000068	11.750967	59
2	8.256094	9.999929	8.256165	11.743835	10.000071	11.743906	58
3	8.263042	9.999927	8.263115	11.736885	10.000073	11.736958	57
4	8 269881	9.999925	8.269956	11.730044	10.000075	11.730119	56
5	8.276614	9.999922	8.276691	11.723309	10.000078	11.723386	55
6	8.283243	9.999920	8.283323	11.716677	10.000080	11.716757	54
7	8.289773	9.999918	8.289856	11.710144	10.000082	11.710227	53
8	8 296207	9.999915	8.296292	11.703708	10.000085	11.703793	52
9	8.302546	9.999913	8.302634	11.697366	10.000087	11.697454	51
10	8 308794	9.999910	8.308884	11.691116	10.000090	11.691206	50
11	8.314954	9 999907	8.315046	11.684954	10.000093	11.685046	49
12	8.321027	9.999905	8.321122	11.678878	10.000095	11.678973	48
13	8 327016	9.999902	8.327114	11.672886	10.000098	11.672984	47
14	8.332924	9.999899	8.333025	11.666975	10.000101	11.667076	46
15	8.338753	9.999897	8.338856	11.661144	10.000103	11.661247	45
16	8.344504	9.999894	8.344610	11.655390	10.000106	11.655496	44
17	8.350181	9.999891	8.350289	11.649711	10.000109	11.649819	43
18	8.355783	9.999888	8.355895	11.644105	10.000112	11.644217	42
19	8.361315	9.999885	8.361430	11.638570	10.000115	11.638685	41
20	8.366777	9.999882	8 366895	11.633105	10.000118	11.633223	40
21	8.372171	9.999879	8.372292	11.627708	10.000121	11.627829	39
22	8.377499	9.999876	8 377622	11.622378	10.000124	11.622501	38
23	8.332762	9.999873	8.382889	11.617111	10.000127	11.617238	37
24	8.387962	9.999870	8 388092	11.611908	10.000130	11.612038	36
25	8.393101	9.999867	8.393234	11.606766	10.000133	11.606899	35
26	8.398179	9.999864	8.398315	11.601685	10.000136	11.601821	34
27	8.403199	9.999861	8.403338	11.596662	10.000139	11.596801	33
28	8.408161	9.999858	8.408304	11.591696	10.000142	11.591839	32
29	8.413068	9.999854	8.413213	11.586787	10.000146	11.586932	31
30	8.417919	9.999851	8.418068	11.581932	10.000149	11.582081	30
31	8.422717	9.999848	8.422869	11.577131	10.000152	11.577283	29
32	8.427462	9.999844	8.427618	11.572382	10.000156	11.572538	28
33	8 432156	9.999841	8.432315	11.567685	10.000159	11.567844	27
34	8.436800	9 999838	8.436962	11.563038	10.000162	11.563200	26
35	8.441394	9.999834	8.441560	11.558440	10.000166	11.558606	25
36	8.445941	9.999831	8.446110	11.553890	10.000169	11.554059	24
37	8.450440	9.999827	8.450613	11.549387	10.000173	11.549560	23
38	8.454893	9.999824	8.455070	11.544930	10.000176	11.545107	22
39	8.459301	9.999820	8.459481	11.540519	10.000180	11.540699	21
40	8.463665	9.999816	8.463849	11.536151	10.000184	11.536335	20
41	8.467985	9.999813	8.468172	11.531828	10.000187	11.532015	19
42	8.472263	9.999809	8.472454	11.527546	10.000191	11.527737	18
43	8.476493	9.999805	8.476693	11.523307	10.000195	11.523502	17
44	8.480693	9.999801	8.480892	11.519108	10.000199	11.519307	16
45	8.484848	9.999797	8.485050	11.514950	10.000203	11.515152	15
46	8.488963	9.999794	8.489170	11.510830	10.000206	11.511037	14
47	8.493040	9.999790	8.493250	11.506750	10.000210	11.506960	13
48	8.497078	9.999786	8.497293	11.502707	10.000214	11.502922	12
49	8.501080	9.999782	8.501298	11.498702	10.000218	11.498920	11
50	8.505045	9.999778	8.505267	11.494733	10.000222	11.494955	10
51	8.508974	9.999774	8.509200	11.490800	10.000226	11.491026	9
52	8.512867	9.999769	8.513098	11.486902	10.000231	11.487133	8
53	8.516726	9.999765	8.516961	11.483039	10.000235	11.483274	7
54	8.520551	9.999761	8.520790	11.479210	10.000239	11.479449	6
55	8.524343	9.999757	8.524586	11.475414	10.000243	11.475657	5
56	8.528102	9.999753	8.528349	11.471651	10.000247	11.471898	4
57	8.531828	9.999748	8.532080	11.467920	10.000252	11.468172	3
58	8.535523	9.999744	8.525779	11.464221	10.000256	11.464477	2
59	8.539186	9.999740	8.539447	11.460553	10.000260	11.460814	1
60	8.542819	9.999735	8.543084	11.456916	10.000265	11.457181	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

88 Degrees.

TABLE II.

LOGARITHMIC SIGNS, TANGENTS AND SECANTS.

2 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	8.542819	9.999735	8.543084	11.456916	10.000265	11.457181	60
1	8.546422	9.999731	8.546691	11.453309	10.000269	11.453578	59
2	8.549995	9.999726	8.550268	11.449732	10.000274	11.450005	58
3	8.553539	9.999722	8.553817	11.446183	10.000278	11.446461	57
4	8.557054	9.999717	8.557336	11.442664	10.000283	11.442946	56
5	8.560540	9.999713	8.560828	11.439172	10.000287	11.439460	55
6	8.563999	9.999708	8.564291	11.435709	10.000292	11.436001	54
7	8.567431	9.999704	8.567727	11.432273	10.000296	11.432569	53
8	8.570836	9.999699	8.571137	11.428863	10.000301	11.429164	52
9	8.574214	9.999694	8.574520	11.425480	10.000306	11.425786	51
10	8.577566	9.999689	8.577877	11.422123	10.000311	11.422434	50
11	8.580892	9.999685	8.581208	11.418792	10.000315	11.419108	49
12	8.584193	9.999680	8.584514	11.415486	10.000320	11.415807	48
13	8.587469	9.999675	8.587795	11.412205	10.000325	11.412531	47
14	8.590721	9.999670	8.591051	11.408949	10.000330	11.409279	46
15	8.593948	9.999665	8.594283	11.405717	10.000335	11.406052	45
16	8.597152	9.999660	8.597492	11.402508	10.000340	11.402848	44
17	8.600332	9.999655	8.600677	11.399323	10.000345	11.399668	43
18	8.603489	9.999650	8.603839	11.396161	10.000350	11.396511	42
19	8.606623	9.999645	8.606978	11.393022	10.000355	11.393377	41
20	8.609734	9.999640	8.610094	11.389906	10.000360	11.390266	40
21	8.612823	9.999635	8.613189	11.386811	10.000365	11.387177	39
22	8.615891	9.999629	8.616262	11.383738	10.000371	11.384109	38
23	8.618937	9.999624	8.619313	11.380687	10.000376	11.381063	37
24	8.621962	9.999619	8.622343	11.377657	10.000381	11.378038	36
25	8.624965	9.999614	8.625352	11.374648	10.000386	11.375035	35
26	8.627948	9.999608	8.628340	11.371660	10.000392	11.372052	34
27	8.630911	9.999603	8.631308	11.368692	10.000397	11.369089	33
28	8.633854	9.999597	8.634256	11.365744	10.000403	11.366146	32
29	8.636776	9.999592	8.637184	11.362816	10.000408	11.363224	31
30	8.639680	9.999586	8.640093	11.359907	10.000414	11.360320	30
31	8.642563	9.999581	8.642982	11.357018	10.000419	11.357437	29
32	8.645428	9.999575	8.645853	11.354147	10.000425	11.354572	28
33	8.648274	9.999570	8.648704	11.351296	10.000430	11.351726	27
34	8.651102	9.999564	8.651537	11.348463	10.000436	11.348898	26
35	8.653911	9.999558	8.654352	11.345648	10.000442	11.346089	25
36	8.656702	9.999553	8.657149	11.342851	10.000447	11.343298	24
37	8.659475	9.999547	8.659928	11.340072	10.000453	11.340525	23
38	8.662230	9.999541	8.662689	11.337311	10.000459	11.337770	22
39	8.664968	9.999535	8.665433	11.334567	10.000465	11.335032	21
40	8.667689	9.999529	8.668160	11.331840	10.000471	11.332311	20
41	8.670393	9.999524	8.670870	11.329130	10.000476	11.329607	19
42	8.673080	9.999518	8.673563	11.326437	10.000482	11.326920	18
43	8.675751	9.999512	8.676239	11.323761	10.000488	11.324249	17
44	8.678405	9.999506	8.678900	11.321100	10.000494	11.321595	16
45	8.681043	9.999500	8.681544	11.318456	10.000500	11.318957	15
46	8.683665	9.999493	8.684172	11.315828	10.000507	11.316335	14
47	8.686272	9.999487	8.686784	11.313216	10.000513	11.313728	13
48	8.688863	9.999481	8.689381	11.310619	10.000519	11.311137	12
49	8.691438	9.999475	8.691963	11.308037	10.000525	11.308562	11
50	8.693998	9.999469	8.694529	11.305471	10.000531	11.306002	10
51	8.696543	9.999463	8.697081	11.302919	10.000537	11.303457	9
52	8.699073	9.999456	8.699617	11.300383	10.000544	11.300927	8
53	8.701589	9.999450	8.702139	11.297861	10.000550	11.298411	7
54	8.704090	9.999443	8.704646	11.295354	10.000557	11.295910	6
55	8.706577	9.999437	8.707140	11.292860	10.000563	11.293423	5
56	8.709049	9.999431	8.709618	11.290382	10.000569	11.290951	4
57	8.711507	9.999424	8.712083	11.287917	10.000576	11.288493	3
58	8.713952	9.999418	8.714534	11.285466	10.000582	11.286048	2
59	8.716383	9.999411	8.716972	11.283028	10.000589	11.283617	1
60	8.718800	9.999404	8.719396	11.280604	10.000596	11.281200	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

87 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

3 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	8.718800	9.999404	8.719396	11.280604	10.000596	11.281200	60
1	8.721204	9.999398	8.721806	11.278194	10.000602	11.278796	59
2	8.723595	9.999391	8.724204	11.275796	10.000609	11.276405	58
3	8.725972	9.999384	8.726588	11.273412	10.000616	11.274028	57
4	8.728337	9.999378	8.728959	11.271041	10.000622	11.271663	56
5	8.730688	9.999371	8.731317	11.268683	10.000629	11.269312	55
6	8.733027	9.999364	8.733663	11.266337	10.000636	11.266973	54
7	8.735354	9.999357	8.735996	11.264004	10.000643	11.264646	53
8	8.737667	9.999350	8.738317	11.261683	10.000650	11.262333	52
9	8.739969	9.999343	8.740626	11.259374	10.000657	11.260031	51
10	8.742259	9.999336	8.742922	11.257078	10.000664	11.257741	50
11	8.744536	9.999329	8.745207	11.254793	10.000671	11.255464	49
12	8.746802	9.999322	8.747479	11.252521	10.000678	11.253198	48
13	8.749055	9.999315	8.749740	11.250260	10.000685	11.250945	47
14	8.751207	9.999308	8.751989	11.248011	10.000692	11.248703	46
15	8.753528	9.999301	8.754227	11.245773	10.000699	11.246472	45
16	8.755747	9.999294	8.756453	11.243547	10.000706	11.244253	44
17	8.757955	9.999287	8.758668	11.241332	10.000713	11.242045	43
18	8.760151	9.999279	8.760872	11.239128	10.000721	11.239849	42
19	8.762337	9.999272	8.763065	11.236935	10.000728	11.237663	41
20	8.764511	9.999265	8.765246	11.234754	10.000735	11.235489	40
21	8.766675	9.999257	8.767417	11.232583	10.000743	11.233325	39
22	8.768828	9.999250	8.769578	11.230422	10.000750	11.231172	38
23	8.770970	9.999242	8.771727	11.228273	10.000758	11.229030	37
24	8.773101	9.999235	8.773866	11.226134	10.000765	11.226899	36
25	8.775223	9.999227	8.775995	11.224005	10.000773	11.224777	35
26	8.777333	9.999220	8.778114	11.221886	10.000780	11.222667	34
27	8.779434	9.999212	8.780222	11.219778	10.000788	11.220566	33
28	8.781524	9.999205	8.782320	11.217680	10.000795	11.218476	32
29	8.783605	9.999197	8.784408	11.215592	10.000803	11.216395	31
30	8.785675	9.999189	8.786486	11.213514	10.000811	11.214325	30
31	8.787736	9.999181	8.788554	11.211446	10.000819	11.212264	29
32	8.789787	9.999174	8.790613	11.209387	10.000826	11.210213	28
33	8.791828	9.999166	8.792662	11.207338	10.000834	11.208172	27
34	8.793859	9.999158	8.794701	11.205299	10.000842	11.206141	26
35	8.795881	9.999150	8.796731	11.203269	10.000850	11.204119	25
36	8.797894	9.999142	8.798752	11.201248	10.000858	11.202106	24
37	8.799897	9.999134	8.800763	11.199237	10.000866	11.200103	23
38	8.801892	9.999126	8.802765	11.197235	10.000874	11.198108	22
39	8.803876	9.999118	8.804758	11.195242	10.000882	11.196124	21
40	8.805852	9.999110	8.806742	11.193258	10.000890	11.194148	20
41	8.807819	9.999102	8.808717	11.191283	10.000898	11.192181	19
42	8.809777	9.999094	8.810683	11.189317	10.000906	11.190223	18
43	8.811726	9.999086	8.812641	11.187359	10.000914	11.188274	17
44	8.813667	9.999077	8.814589	11.185411	10.000923	11.186333	16
45	8.815599	9.999069	8.816529	11.183471	10.000931	11.184401	15
46	8.817522	9.999061	8.818461	11.181539	10.000939	11.182478	14
47	8.819436	9.999053	8.820384	11.179616	10.000947	11.180564	13
48	8.821343	9.999044	8.822298	11.177702	10.000956	11.178657	12
49	8.823240	9.999036	8.824205	11.175795	10.000964	11.176760	11
50	8.825130	9.999027	8.826103	11.173897	10.000973	11.174870	10
51	8.827011	9.999019	8.827992	11.172008	10.000981	11.172989	9
52	8.828884	9.999010	8.829874	11.170126	10.000990	11.171116	8
53	8.830749	9.999002	8.831748	11.168252	10.000998	11.169251	7
54	8.832607	9.998993	8.833613	11.166387	10.001007	11.167393	6
55	8.831456	9.998984	8.835471	11.164529	10.001016	11.165544	5
56	8.836297	9.998976	8.837321	11.162679	10.001024	11.163703	4
57	8.838130	9.998967	8.839163	11.160837	10.001033	11.161870	3
58	8.839956	9.998958	8.840998	11.159002	10.001042	11.160044	2
59	8.841774	9.998950	8.842825	11.157175	10.001050	11.158226	1
60	8.843585	9.998941	8.844644	11.155356	10.001059	11.156415	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

86 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

4 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	8.843585	9.998941	8.844644	11.155356	10.001059	11.156415	60
1	8.845387	9.998932	8.846455	11.153545	10.001068	11.154613	59
2	8.847183	9.998923	8.848260	11.151740	10.001077	11.152817	58
3	8.848971	9.998914	8.850057	11.149943	10.001086	11.151029	57
4	8.850751	9.998905	8.851846	11.148154	10.001095	11.149249	56
5	8.852525	9.998896	8.853628	11.146372	10.001104	11.147475	55
6	8.854291	9.998887	8.855403	11.144597	10.001113	11.145709	54
7	8.856049	9.998878	8.857171	11.142829	10.001122	11.143951	53
8	8.857801	9.998869	8.858932	11.141068	10.001131	11.142199	52
9	8.859546	9.998860	8.860686	11.139314	10.001140	11.140454	51
10	8.861283	9.998851	8.862433	11.137567	10.001149	11.138717	50
11	8.863014	9.998841	8.864173	11.135827	10.001159	11.136986	49
12	8.864738	9.998832	8.865906	11.134094	10.001168	11.135262	48
13	8.866455	9.998823	8.867632	11.132368	10.001177	11.133545	47
14	8.868165	9.998813	8.869351	11.130649	10.001187	11.131835	46
15	8.869868	9.998804	8.871064	11.128936	10.001196	11.130132	45
16	8.871565	9.998795	8.872770	11.127230	10.001205	11.128435	44
17	8.873255	9.998785	8.874469	11.125531	10.001215	11.126745	43
18	8.874938	9.998776	8.876162	11.123838	10.001224	11.125062	42
19	8.876615	9.998766	8.877849	11.122151	10.001234	11.123385	41
20	8.878285	9.998757	8.879529	11.120471	10.001243	11.121715	40
21	8.879949	9.998747	8.881202	11.118798	10.001253	11.120051	39
22	8.881607	9.998738	8.882869	11.117131	10.001262	11.118393	38
23	8.883258	9.998728	8.884530	11.115470	10.001272	11.116742	37
24	8.884903	9.998718	8.886185	11.113815	10.001282	11.115097	36
25	8.886542	9.998708	8.887833	11.112167	10.001292	11.113458	35
26	8.888174	9.998699	8.889476	11.110524	10.001301	11.111826	34
27	8.889801	9.998689	8.891112	11.108888	10.001311	11.110199	33
28	8.891421	9.998679	8.892742	11.107258	10.001321	11.108579	32
29	8.893035	9.998669	8.894366	11.105634	10.001331	11.106965	31
30	8.894643	9.998659	8.895984	11.104016	10.001341	11.105357	30
31	8.896246	9.998649	8.897596	11.102404	10.001351	11.103754	29
32	8.897842	9.998639	8.899203	11.100797	10.001361	11.102158	28
33	8.899432	9.998629	8.900803	11.099197	10.001371	11.100568	27
34	8.901017	9.998619	8.902398	11.097602	10.001381	11.098983	26
35	8.902596	9.998609	8.903987	11.096013	10.001391	11.097404	25
36	8.904169	9.998599	8.905570	11.094430	10.001401	11.095831	24
37	8.905736	9.998589	8.907147	11.092853	10.001411	11.094264	23
38	8.907297	9.998578	8.908719	11.091281	10.001422	11.092703	22
39	8.908853	9.998568	8.910285	11.089715	10.001432	11.091147	21
40	8.910404	9.998558	8.911846	11.088154	10.001442	11.089596	20
41	8.911949	9.998548	8.913401	11.086599	10.001452	11.088051	19
42	8.913488	9.998537	8.914951	11.085049	10.001463	11.086512	18
43	8.915022	9.998527	8.916495	11.083505	10.001473	11.084978	17
44	8.916550	9.998516	8.918034	11.081966	10.001484	11.083450	16
45	8.918073	9.998506	8.919568	11.080432	10.001494	11.081927	15
46	8.919591	9.998495	8.921096	11.078904	10.001505	11.080409	14
47	8.921103	9.998485	8.922619	11.077381	10.001515	11.078897	13
48	8.922610	9.998474	8.924136	11.075864	10.001526	11.077390	12
49	8.924112	9.998464	8.925649	11.074351	10.001536	11.075888	11
50	8.925609	9.998453	8.927156	11.072844	10.001547	11.074391	10
51	8.927100	9.998442	8.928658	11.071342	10.001558	11.072900	9
52	8.928587	9.998431	8.930155	11.069845	10.001569	11.071413	8
53	8.930068	9.998421	8.931647	11.068353	10.001579	11.069932	7
54	8.931544	9.998410	8.933134	11.066866	10.001590	11.068456	6
55	8.933015	9.998399	8.934616	11.065384	10.001601	11.066985	5
56	8.934481	9.998388	8.936093	11.063907	10.001612	11.065519	4
57	8.935942	9.998377	8.937565	11.062435	10.001623	11.064058	3
58	8.937398	9.998366	8.939032	11.060968	10.001634	11.062602	2
59	8.938850	9.998355	8.940494	11.059506	10.001645	11.061150	1
60	8.940296	9.998344	8.941952	11.058048	10.001656	11.059704	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

85 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

5 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	8.940296	9.998344	8.941952	11.058048	10.001656	11.059704	60
1	8.941738	9.998333	8.943404	11.056596	10.001667	11.058262	59
2	8.943174	9.998322	8.944852	11.055148	10.001678	11.056826	58
3	8.944606	9.998311	8.946295	11.053705	10.001689	11.055394	57
4	8.946034	9.998300	8.947734	11.052266	10.001700	11.053966	56
5	8.947456	9.998289	8.949168	11.050832	10.001711	11.052544	55
6	8.948874	9.998277	8.950597	11.049403	10.001723	11.051126	54
7	8.950287	9.998266	8.952021	11.047979	10.001734	11.049713	53
8	8.951696	9.998255	8.953441	11.046559	10.001745	11.048304	52
9	8.953100	9.998243	8.954856	11.045144	10.001757	11.046900	51
10	8.954499	9.998232	8.956267	11.043733	10.001768	11.045501	50
11	8.955894	9.998220	8.957674	11.042326	10.001780	11.044106	49
12	8.957284	9.998209	8.959075	11.040925	10.001791	11.042716	48
13	8.958670	9.998197	8.960473	11.039527	10.001803	11.041330	47
14	8.960052	9.998186	8.961866	11.038134	10.001814	11.039948	46
15	8.961429	9.998174	8.963255	11.033745	10.001826	11.038571	45
16	8.962801	9.998163	8.964639	11.035361	10.001837	11.037199	44
17	8.964170	9.998151	8.966019	11.033981	10.001849	11.035830	43
18	8.965534	9.998139	8.967394	11.032606	10.001861	11.034466	42
19	8.966893	9.998128	8.968766	11.031234	10.001872	11.033107	41
20	8.968249	9.998116	8.970133	11.029867	10.001884	11.031751	40
21	8.969600	9.998104	8.971496	11.028504	10.001896	11.030400	39
22	8.970947	9.998092	8.972855	11.027145	10.001908	11.029053	38
23	8.972289	9.998080	8.974209	11.025791	10.001920	11.027711	37
24	8.973628	9.998068	8.975560	11.024440	10.001932	11.026372	36
25	8.974962	9.998056	8.976906	11.023094	10.001944	11.025038	35
26	8.976293	9.998044	8.978248	11.021752	10.001956	11.023707	34
27	8.977619	9.998032	8.979586	11.020414	10.001968	11.022381	33
28	8.978941	9.998020	8.980921	11.019079	10.001980	11.021059	32
29	8.980259	9.998008	8.982251	11.017749	10.001992	11.019741	31
30	8.981573	9.997996	8.983577	11.016423	10.002004	11.018427	30
31	8.982883	9.997984	8.984899	11.015101	10.002016	11.017117	29
32	8.984189	9.997972	8.986217	11.013783	10.002028	11.015811	28
33	8.985491	9.997959	8.987532	11.012468	10.002041	11.014509	27
34	8.986789	9.997947	8.988842	11.011158	10.002053	11.013211	26
35	8.988083	9.997935	8.990149	11.009851	10.002065	11.011917	25
36	8.989374	9.997922	8.991451	11.008549	10.002078	11.010626	24
37	8.990660	9.997910	8.992750	11.007250	10.002090	11.009340	23
38	8.991943	9.997897	8.994045	11.005955	10.002103	11.008057	22
39	8.993222	9.997885	8.995337	11.004663	10.002115	11.006778	21
40	8.994497	9.997872	8.996624	11.003376	10.002128	11.005503	20
41	8.995768	9.997860	8.997908	11.002092	10.002140	11.004232	19
42	8.997036	9.997847	8.999188	11.000812	10.002153	11.002964	18
43	8.998299	9.997835	9.000465	10.999535	10.002165	11.001701	17
44	8.999560	9.997822	9.001738	10.998262	10.002178	11.000440	16
45	9.000816	9.997809	9.003007	10.996993	10.002191	10.999184	15
46	9.002069	9.997797	9.004272	10.995728	10.002203	10.997931	14
47	9.003318	9.997784	9.005534	10.994466	10.002216	10.996682	13
48	9.004563	9.997771	9.006792	10.993208	10.002229	10.995437	12
49	9.005805	9.997758	9.008047	10.991953	10.002242	10.994195	11
50	9.007044	9.997745	9.009298	10.990702	10.002255	10.992956	10
51	9.008278	9.997732	9.010546	10.989454	10.002268	10.991722	9
52	9.009510	9.997719	9.011790	10.988210	10.002281	10.990490	8
53	9.010737	9.997706	9.013031	10.986969	10.002294	10.989263	7
54	9.011962	9.997693	9.014268	10.985732	10.002307	10.988038	6
55	9.013182	9.997680	9.015502	10.984498	10.002320	10.986818	5
56	9.014400	9.997667	9.016732	10.983268	10.002333	10.985600	4
57	9.015613	9.997654	9.017959	10.982041	10.002346	10.984387	3
58	9.016824	9.997641	9.019183	10.980817	10.002359	10.983176	2
59	9.018031	9.997628	9.020403	10.979597	10.002372	10.981969	1
60	9.019235	9.997614	9.021620	10.978380	10.002386	10.980765	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

84 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

6 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.019235	9.997614	9.021620	10.978380	10.002386	10.980765	60
1	9.020435	9.997601	9.022834	10.977166	10.002399	10.979565	59
2	9.021632	9.997588	9.024044	10.975956	10.002412	10.978368	58
3	9.022825	9.997574	9.025251	10.974749	10.002426	10.977175	57
4	9.024016	9.997561	9.026455	10.973545	10.002439	10.975984	56
5	9.025203	9.997547	9.027655	10.972345	10.002453	10.974797	55
6	9.026386	9.997534	9.028852	10.971148	10.002466	10.973614	54
7	9.027567	9.997520	9.030046	10.969954	10.002480	10.972433	53
8	9.028744	9.997507	9.031237	10.968763	10.002493	10.971256	52
9	9.029918	9.997493	9.032425	10.967575	10.002507	10.970082	51
10	9.031089	9.997480	9.033609	10.966391	10.002520	10.968911	50
11	9.032257	9.997466	9.034791	10.965209	10.002534	10.967743	49
12	9.033421	9.997452	9.035969	10.964031	10.002548	10.966579	48
13	9.034582	9.997439	9.037144	10.962856	10.002561	10.965418	47
14	9.035741	9.997425	9.038316	10.961684	10.002575	10.964259	46
15	9.036896	9.997411	9.039485	10.960515	10.002589	10.963104	45
16	9.038048	9.997397	9.040651	10.959349	10.002603	10.961952	44
17	9.039197	9.997383	9.041813	10.958187	10.002617	10.960803	43
18	9.040342	9.997369	9.042973	10.957027	10.002631	10.959658	42
19	9.041485	9.997355	9.044130	10.955870	10.002645	10.958515	41
20	9.042625	9.997341	9.045284	10.954716	10.002659	10.957375	40
21	9.043762	9.997327	9.046434	10.953566	10.002673	10.956238	39
22	9.044895	9.997313	9.047582	10.952418	10.002687	10.955105	38
23	9.046026	9.997299	9.048727	10.951273	10.002701	10.953974	37
24	9.047154	9.997285	9.049869	10.950131	10.002715	10.952846	36
25	9.048279	9.997271	9.051008	10.948992	10.002729	10.951721	35
26	9.049400	9.997257	9.052144	10.947856	10.002743	10.950600	34
27	9.050519	9.997242	9.053277	10.946723	10.002758	10.949481	33
28	9.051635	9.997228	9.054407	10.945593	10.002772	10.948365	32
29	9.052749	9.997214	9.055535	10.944465	10.002786	10.947251	31
30	9.053859	9.997199	9.056659	10.943341	10.002801	10.946141	30
31	9.054966	9.997185	9.057781	10.942219	10.002815	10.945034	29
32	9.056071	9.997170	9.058900	10.941100	10.002830	10.943929	28
33	9.057172	9.997156	9.060016	10.939984	10.002844	10.942828	27
34	9.058271	9.997141	9.061130	10.938870	10.002859	10.941729	26
35	9.059367	9.997127	9.062240	10.937760	10.002873	10.940633	25
36	9.060460	9.997112	9.063348	10.936652	10.002888	10.939540	24
37	9.061551	9.997098	9.064453	10.935547	10.002902	10.938449	23
38	9.062639	9.997083	9.065556	10.934444	10.002917	10.937361	22
39	9.063724	9.997068	9.066655	10.933345	10.002932	10.936276	21
40	9.064806	9.997053	9.067752	10.932248	10.002947	10.935194	20
41	9.065885	9.997039	9.068846	10.931154	10.002961	10.934115	19
42	9.066962	9.997024	9.069938	10.930062	10.002976	10.933038	18
43	9.068036	9.997009	9.071027	10.928973	10.002991	10.931964	17
44	9.069107	9.996994	9.072113	10.927887	10.003006	10.930893	16
45	9.070176	9.996979	9.073197	10.926803	10.003021	10.929824	15
46	9.071242	9.996964	9.074278	10.925722	10.003036	10.928758	14
47	9.072306	9.996949	9.075356	10.924644	10.003051	10.927694	13
48	9.073366	9.996934	9.076432	10.923568	10.003066	10.926634	12
49	9.074424	9.996919	9.077505	10.922495	10.003081	10.925576	11
50	9.075480	9.996904	9.078576	10.921424	10.003096	10.924520	10
51	9.076533	9.996889	9.079644	10.920356	10.003111	10.923467	9
52	9.077583	9.996874	9.080710	10.919290	10.003126	10.922417	8
53	9.078631	9.996858	9.081773	10.918227	10.003142	10.921369	7
54	9.079676	9.996843	9.082833	10.917167	10.003157	10.920324	6
55	9.080719	9.996828	9.083891	10.916109	10.003172	10.919281	5
56	9.081759	9.996812	9.084947	10.915053	10.003188	10.918241	4
57	9.082797	9.996797	9.086000	10.914000	10.003203	10.917203	3
58	9.083832	9.996782	9.087050	10.912950	10.003218	10.916168	2
59	9.084864	9.996766	9.088098	10.911902	10.003234	10.915136	1
60	9.085894	9.996751	9.089144	10.910856	10.003249	10.914106	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

83 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

7 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.085894	9.996751	9.089144	10.910856	10.003249	10.914106	60
1	9.086922	9.996735	9.090187	10.909813	10.003265	10.913078	59
2	9.087947	9.996720	9.091228	10.908772	10.003280	10.912053	58
3	9.088970	9.996704	9.092266	10.907734	10.003296	10.911030	57
4	9.089990	9.996688	9.093302	10.906698	10.003312	10.910010	56
5	9.091008	9.996673	9.094336	10.905664	10.003327	10.908992	55
6	9.092024	9.996657	9.095367	10.904633	10.003343	10.907976	54
7	9.093037	9.996641	9.096395	10.903605	10.003359	10.906963	53
8	9.094047	9.996625	9.097422	10.902578	10.003375	10.905953	52
9	9.095056	9.996610	9.098446	10.901554	10.003390	10.904944	51
10	9.096062	9.996594	9.099468	10.900532	10.003406	10.903938	50
11	9.097065	9.996578	9.100487	10.899513	10.003422	10.902935	49
12	9.098066	9.996562	9.101504	10.898496	10.003438	10.901934	48
13	9.099065	9.996546	9.102519	10.897481	10.003454	10.900935	47
14	9.100062	9.996530	9.103532	10.896468	10.003470	10.899938	46
15	9.101056	9.996514	9.104542	10.895458	10.003486	10.898944	45
16	9.102048	9.996498	9.105550	10.894450	10.003502	10.897952	44
17	9.103037	9.996482	9.106556	10.893444	10.003518	10.896963	43
18	9.104025	9.996465	9.107559	10.892441	10.003535	10.895975	42
19	9.105010	9.996449	9.108560	10.891440	10.003551	10.894990	41
20	9.105992	9.996433	9.109559	10.890441	10.003567	10.894008	40
21	9.106973	9.996417	9.110556	10.889444	10.003583	10.893027	39
22	9.107951	9.996400	9.111551	10.888449	10.003600	10.892049	38
23	9.108927	9.996384	9.112543	10.887457	10.003616	10.891073	37
24	9.109901	9.996368	9.113533	10.886467	10.003632	10.890099	36
25	9.119873	9.996351	9.114521	10.885479	10.003649	10.889127	35
26	9.111842	9.996335	9.115507	10.884493	10.003665	10.888158	34
27	9.112809	9.996318	9.116491	10.883509	10.003682	10.887191	33
28	9.113774	9.996302	9.117472	10.882528	10.003698	10.886226	32
29	9.114737	9.996285	9.118452	10.881548	10.003715	10.885263	31
30	9.115698	9.996269	9.119429	10.880571	10.003731	10.884302	30
31	9.116656	9.996252	9.120404	10.879596	10.003748	10.883344	29
32	9.117613	9.996235	9.121377	10.878623	10.003765	10.882387	28
33	9.118567	9.996219	9.122348	10.877652	10.003781	10.881433	27
34	9.119519	9.996202	9.123317	10.876683	10.003798	10.880481	26
35	9.120469	9.996185	9.124284	10.875716	10.003815	10.879531	25
36	9.121417	9.996168	9.125249	10.874751	10.003832	10.878583	24
37	9.122362	9.996151	9.126211	10.873789	10.003849	10.877638	23
38	9.123306	9.996134	9.127172	10.872828	10.003866	10.876694	22
39	9.124248	9.996117	9.128130	10.871870	10.003883	10.875752	21
40	9.125187	9.996100	9.129087	10.870913	10.003900	10.874813	20
41	9.126125	9.996083	9.130041	10.869959	10.003917	10.873875	19
42	9.127060	9.996066	9.130994	10.869006	10.003934	10.872940	18
43	9.127993	9.996049	9.131944	10.868056	10.003951	10.872007	17
44	9.128925	9.996032	9.132893	10.867107	10.003968	10.871075	16
45	9.129854	9.996015	9.133839	10.866161	10.003985	10.870146	15
46	9.130781	9.995998	9.134784	10.865216	10.004002	10.869219	14
47	9.131706	9.995980	9.135726	10.864274	10.004020	10.868294	13
48	9.132630	9.995963	9.136667	10.863333	10.004037	10.867370	12
49	9.133551	9.995946	9.137605	10.862395	10.004054	10.866449	11
50	9.134470	9.995928	9.138542	10.861458	10.004072	19.865530	10
51	9.135387	9.995911	9.139476	10.860524	10.004089	10.864613	9
52	9.136303	9.995894	9.140409	10.859591	10.004106	10.863697	8
53	9.137216	9.995876	9.141340	10.858660	10.004124	10.862784	7
54	9.138128	9.995859	9.142269	10.857731	10.004141	10.861872	6
55	9.139037	9.995841	9.143196	10.856804	10.004159	10.860963	5
56	9.139944	9.995823	9.144121	10.855879	10.004177	10.860056	4
57	9.140850	9.995806	9.145044	10.854956	10.004194	10.859150	3
58	9.141754	9.995788	9.145966	10.854034	10.004212	10.858246	2
59	9.142655	9.995771	9.146885	10.853115	10.004229	10.857345	1
60	9.143555	9.995753	9.147803	10.852197	10.004247	10.856445	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

82 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

8 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.143555	9.995753	9.147803	10.852197	10 004247	10.856445	60
1	9.144453	9.995735	9.148718	10.851282	10.004265	10.855547	59
2	9.145349	9.995717	9.149632	10.850368	10.004283	10.854651	58
3	9.146243	9.995699	9.150544	10.849456	10.004301	10.853757	57
4	9.147136	9.995681	9.151454	10.848546	10.004319	10.852864	56
5	9.148026	9.995664	9.152363	10.847637	10.004336	10.851974	55
6	9.148915	9.995646	9.153269	10.846731	10 004354	10.851085	54
7	9.149802	9.995628	9.154174	10.845826	10.004372	10.850198	53
8	9.150686	9.995610	9.155077	10.844923	10.004390	10.849314	52
9	9.151569	9.995591	9.155978	10.844022	10.004409	10.848431	51
10	9.152451	9.995573	9.156877	10.843123	10.004427	10.847549	50
11	9.153330	9.995555	9.157775	10.842225	10.004445	10.846670	49
12	9.154208	9.995537	9.158671	10.841329	10.004463	10.845792	48
13	9.155083	9.995519	9.159565	10.840435	10.004481	10.844917	47
14	9.155957	9.995501	9.160457	10.839543	10.004499	10.844043	46
15	9.156830	9.995482	9.161347	10.838653	10.004518	16 843170	45
16	9.157700	9.995464	9.162236	10.837764	10.004536	10.842300	44
17	9.158569	9.995446	9.163123	10.836877	10.004554	10.841431	43
18	9.159435	9.995427	9.164008	10.835992	10.004573	10.840565	42
19	9.160301	9.995409	9.164892	10.835108	10.004591	10.839699	41
20	9.161164	9.995390	9.165774	10.834226	10.004610	10.838836	40
21	9.162025	9.995372	9.166654	10.833346	10.004628	10.837975	39
22	9.162885	9.995353	9.167532	10.832468	10.004647	10.837115	38
23	9.163743	9.995334	9.168409	10.831591	10.004666	10.836257	37
24	9.164600	9.995316	9.169284	10.830716	10.004684	10.835400	36
25	9.165454	9.995297	9.170157	10.829843	10.004703	10.834546	35
26	9.166307	9.995278	9.171029	10.828971	10.004722	10.833693	34
27	9.167159	9.995260	9.171899	10.828101	10.004740	10.832841	33
28	9.168008	9 995241	9.172767	10.827233	10.004759	10.831992	32
29	9.168856	9.995222	9.173634	10.826366	10.004778	10.831144	31
30	9 169702	9.995203	9.174499	10.825501	10.004797	10.830298	30
31	9.170547	9.995184	9.175362	10.824638	10.004816	10.829453	29
32	9.171389	9.995165	9.176224	10.823776	10.004835	10.828611	28
33	9.172230	9.995146	9.177084	10.822916	10.004854	10.827770	27
34	9.173070	9.995127	9.177942	10.822058	10.004873	10.826930	26
35	9.173908	9.995108	9.178799	10.821201	10.004892	10.826092	25
36	9.174744	9.995089	9.179655	10.820345	10.004911	10.825256	24
37	9.175578	9.995070	9.180508	10.819492	10.004930	10.824422	23
38	9.176411	9.995051	9.181360	10.818640	10.004949	10.823589	22
39	9.177242	9.995032	9.182211	10.817789	10.004968	10.822758	21
40	9.178072	9.995013	9.183059	10.816941	10.004987	10.821928	20
41	9.178900	9.994993	9.183907	10.816093	10.005007	10.821100	19
42	9.179726	9.994974	9.184752	10.815248	10.005026	10.820274	18
43	9.180551	9.994955	9.185597	10.814403	10.005045	10.819449	17
44	9.181374	9.994935	9.186439	10.813561	10.005065	10.818626	16
45	9.182196	9.994916	9.187280	10.812720	10.005084	10.817804	15
46	9.183016	9.994896	9.188120	10.811880	10.005104	10.816984	14
47	9.183834	9.994877	9.188958	10.811042	10.005123	10.816166	13
48	9.184651	9.994857	9.189794	10.810206	10.005143	10.815349	12
49	9.185466	9.994838	9.190629	10.809371	10.005162	10.814534	11
50	9.186280	9.994818	9.191462	10.808538	10.005182	10.813720	10
51	9.187092	9.994798	9.192294	10.807706	10.005202	10.812908	9
52	9.187903	9.994779	9.193125	10.806876	10.005221	10.812097	8
53	9.188712	9.994759	9.193953	10.806047	10.005241	10.811288	7
54	9.189519	9.994739	9.194780	10.805220	10.005261	10.810481	6
55	9.190325	9.994720	9.195606	10.804394	10.005281	10.809675	5
56	9.191130	9.994700	9.196430	10.803570	10.005300	10.808870	4
57	9.191933	9.994680	9.197253	10.802747	10.005320	10.808067	3
58	9.192734	9.994660	9.198074	10.801926	10.005340	10.807266	2
59	9.193534	9.994640	9.198894	10.801106	10.005360	10.806466	1
60	9.194332	9.994620	9.199713	10.800287	10.005380	10.805668	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

81 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

9 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.194332	9.994620	9.199713	10.800287	10.005380	10.805668	60
1	9.195129	9.994600	9.200529	10.799471	10.005400	10.804871	59
2	9.195925	9.994580	9.201345	10.798655	10.005420	10.804075	58
3	9.196719	9.994560	9.202159	10.797841	10.005440	10.803281	57
4	9.197511	9.994540	9.202971	10.797029	10.005460	10.802489	56
5	9.198302	9.994519	9.203782	10.796218	10.005481	10.801698	55
6	9.199091	9.994499	9.204592	10.795408	10.005501	10.800909	54
7	9.199879	9.994479	9.205400	10.794600	10.005521	10.800121	53
8	9.200666	9.994459	9.206207	10.793793	10.005541	10.799334	52
9	9.201451	9.994438	9.207013	10.792987	10.005562	10.798549	51
10	9.202234	9.994418	9.207817	10.792183	10.005582	10.797766	50
11	9.203017	9.994398	9.208619	10.791381	10.005602	10.796983	49
12	9.203797	9.994377	9.209420	10.790580	10.005623	10.796203	48
13	9.204577	9.994357	9.210220	10.789780	10.005643	10.795423	47
14	9.205354	9.994336	9.211018	10.788982	10.005664	10.794646	46
15	9.206131	9.994316	9.211815	10.788185	10.005684	10.793869	45
16	9.206906	9.994295	9.212611	10.787389	10.005705	10.793094	44
17	9.207679	9.994274	9.213405	10.786595	10.005726	10.792321	43
18	9.208452	9.994254	9.214198	10.785802	10.005746	10.791548	42
19	9.209222	9.994233	9.214989	10.785011	10.005767	10.790778	41
20	9.209992	9.994212	9.215780	10.784220	10.005788	10.790008	40
21	9.210760	9.994191	9.216568	10.783432	10.005809	10.789240	39
22	9.211526	9.994171	9.217356	10.782644	10.005829	10.788474	38
23	9.212291	9.994150	9.218142	10.781858	10.005850	10.787709	37
24	9.213055	9.994129	9.218926	10.781074	10.005871	10.786945	36
25	9.213818	9.994108	9.219710	10.780290	10.005892	10.786182	35
26	9.214579	9.994087	9.220492	10.779508	10.005913	10.785421	34
27	9.215338	9.994066	9.221272	10.778728	10.005934	10.784662	33
28	9.216097	9.994045	9.222052	10.777948	10.005955	10.783903	32
29	9.216854	9.994024	9.222830	10.777170	10.005976	10.783146	31
30	9.217609	9.994003	9.223607	10.776393	10.005997	10.782391	30
31	9.218363	9.993982	9.224382	10.775618	10.006018	10.781637	29
32	9.219116	9.993960	9.225156	10.774844	10.006040	10.780884	28
33	9.219868	9.993939	9.225929	10.774071	10.006061	10.780132	27
34	9.220618	9.993918	9.226700	10.773300	10.006082	10.779382	26
35	9.221367	9.993897	9.227471	10.772529	10.006103	10.778633	25
36	9.222115	9.993875	9.228239	10.771761	10.006125	10.777885	24
37	9.222861	9.993854	9.229007	10.770993	10.006146	10.777139	23
38	9.223606	9.993832	9.229773	10·770227	10.006168	10.776394	22
39	9.224349	9.993811	9.230539	10.769461	10.006189	10.775651	21
40	9.225092	9.993789	9.231302	10.768698	10.006211	19.774908	20
41	9.225833	9.993768	9.232065	10.767935	10.006232	10.774167	19
42	9.226573	9.993746	9 232826	10.767174	10.006254	10.773427	18
43	9.227311	9.993725	9.233586	10.766414	10.006275	10.772689	17
44	9.228048	9.993703	9.234345	10.765655	10.006297	10.771952	16
45	9.228784	9.993681	9.235103	10.764897	10.006319	10.771216	15
46	9.229518	9.993660	9 235859	10.764141	10.006340	10.770482	14
47	9.230252	9.993638	9.236614	10.763386	10.006362	10.769748	13
48	9.230984	9.993616	9.237368	10.762632	10.006384	10.769016	12
49	9.231715	9.993594	9.238120	10.761880	10.006406	10.768285	11
50	9.232444	9.993572	9.238872	10.761128	10.006428	10.767556	10
51	9.233172	9.993550	9.239622	10.760378	10.006450	10.766828	9
52	9.233899	9.993528	9.240371	10.759629	10.006472	10.766101	8
53	9.234625	9.993506	9.241118	10.758882	10.006494	10.765375	7
54	9.235349	9.993484	9.241865	10.758135	10.006516	10.764651	6
55	9.236073	9.993462	9.242610	10.757390	10.006538	10.763927	5
56	9.236795	9.993440	9.243353	10.756646	10.006560	10.763205	4
57	9.237515	9.993418	9.244097	10.755903	10.006582	10.762485	3
58	9.238235	9.993396	9.244839	10.755161	10.006604	10.761765	2
59	9.238953	9.993374	9.245579	10.754421	10.006626	10.761047	1
60	9.239670	9.993351	9.246319	10.753681	10.006649	10.760330	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

80 Degrees.

TABLE II.

LOGARITHMIC SIGNS, TANGENTS AND SECANTS.

10 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.239670	9.993351	9.246319	10.753681	10.006649	10.760330	60
1	9.240386	9.993329	9.247057	10.752943	10.006671	10.759614	59
2	9.241101	9.993307	9.247794	10.752206	10.006693	10.758899	58
3	9.241814	9.993285	9.248530	10.751470	10.006715	10.758186	57
4	9.242526	9.993262	9.249264	10.750736	10.006738	10.757474	56
5	9.243237	9.993240	9.249998	10.750002	10.006760	10.756763	55
6	9.243947	9.993217	9.250730	10.749270	10.006783	10.756053	54
7	9.244656	9.993195	9.251461	10.748539	10.006805	10.755344	53
8	9.245363	9.993172	9.252191	10.747809	10.006828	10.754637	52
9	9.246069	9.993149	9.252920	10.747080	10.006851	10.753931	51
10	9.246775	9.993127	9.253648	10.746352	10.006873	10.753225	50
11	9.247478	9.993104	9.254374	10.745626	10.006896	10.752522	49
12	9.248181	9.993081	9.255100	10.744900	10.006919	10.751819	48
13	9.248883	9.993059	9.255824	10.744176	10.006941	10.751117	47
14	9.249583	9.993036	9.256547	10.743453	10.006964	10.750417	46
15	9.250282	9.993013	9.257269	10.742731	10.006987	10.749718	45
16	9.250980	9.992990	9.257990	10.742010	10.007010	10.749020	44
17	9.251677	9.992967	9.258710	10.741290	10.007033	10.748323	43
18	9.252373	9.992944	9.259429	10.740571	10.007056	10.747627	42
19	9.253067	9.992921	9.260146	10.739854	10.007079	10.746933	41
20	9.253761	9.992898	9.260863	10.739137	10.007102	10.746239	40
21	9.254453	9.992875	9.261578	10.738422	10.007125	10.745547	39
22	9.255144	9.992852	9.262292	10.737708	10.007148	10.744856	38
23	9.255834	9.992829	9.263005	10.736995	10.007171	10.744166	37
24	9.256523	9.992806	9.263717	10.736283	10.007194	10.743477	36
25	9.257211	9.992783	9.264428	10.735572	10.007217	10.742789	35
26	9.257898	9.992759	9.265138	10.734862	10.007241	10.742102	34
27	9.258583	9.992736	9.265847	10.734153	10.007264	10.741417	33
28	9.259268	9.992713	9.266555	10.733445	10.007287	10.740732	32
29	9.259951	9.992690	9.267261	10.732739	10.007311	10.740049	31
30	9.260633	9.992666	9.267967	10.732033	10.007334	10.739367	30
31	9.261314	9.992643	9.268671	10.731329	10.007357	10.738686	29
32	9.261994	9.992619	9.269375	10.730625	10.007381	10.738006	28
33	9.262673	9.992596	9.270077	10.729923	10.007404	10.737327	27
34	9.263351	9.992572	9.270779	10.729221	10.007428	10.736649	26
35	9.264027	9.992549	9.271479	10.728521	10.007451	10.735973	25
36	9.264703	9.992525	9.272178	10.727822	10.007475	10.735297	24
37	9.265377	9.992501	9.272876	10.727124	10.007499	10.734623	23
38	9.266051	9.992478	9.273573	10.726427	10.007522	10.733949	22
39	9.266723	9.992454	9.274269	10.725731	10.007546	10.733277	21
40	9.267395	9.992430	9.274964	10.725036	10.007570	10.732605	20
41	9.268065	9.992406	9.275658	10.724342	10.007594	10.731935	19
42	9.268734	9.992382	9.276351	10.723649	10.007618	10.731266	18
43	9.269402	9.992358	9.277043	10.722957	10.007642	10.730598	17
44	9.270069	9.992335	9.277734	10.722266	10.007665	10.729931	16
45	9.270735	9.992311	9.278424	10.721576	10.007689	10.729265	15
46	9.271400	9.992287	9.279113	10.720887	10.007713	10.728600	14
47	9.272064	9.992263	9.279801	10.720199	10.007737	10.727936	13
48	9.272726	9.992239	9.280488	10.719512	10.007761	10.727274	12
49	9.273388	9.992214	9.281174	10.718826	10.007786	10.726612	11
50	9.274049	9.992190	9.281858	10.718142	10.007810	10.725951	10
51	9.274708	9.992166	9.282542	10.717458	10.007834	10.725292	9
52	9.275367	9.992142	9.283225	10.716775	10.007858	10.724633	8
53	9.276025	9.992118	9.283907	10.716093	10.007882	10.723975	7
54	9.276681	9.992093	9.284588	10.715412	10.007907	10.723319	6
55	9.277337	9.992069	9.285268	10.714732	10.007931	10.722663	5
56	9.277991	9.992044	9.285947	10.714053	10.007956	10.722009	4
57	9.278645	9.992020	9.286624	10.713376	10.007980	10.721355	3
58	9.279297	9.991996	9.287301	10.712699	10.008004	10.720703	2
59	9.279948	9.991971	9.287977	10.712023	10.008029	10.720052	1
60	9.280599	9.991947	9.288652	10.711348	10.008053	10.719401	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

79 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

11 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.280599	9.991947	9.288652	10 711348	10.008053	10.719401	60
1	9.281248	9.991922	9.289326	10.710674	10.008078	10.718752	59
2	9.281897	9.991897	9.289999	10.710001	10.008103	10.718103	58
3	9.282544	9.991873	9.290671	10.709329	10.008127	10.717456	57
4	9 283190	9.991848	9.291342	10.708658	10.008152	10.716810	56
5	9.283836	9.991823	9.292013	10.707987	10.008177	10.716164	55
6	9.284480	9.991799	9.292682	10.707318	10.008201	10.715520	54
7	9.285124	9.991774	9.293350	10.706650	10.008226	10.714876	53
8	9.285766	9.991749	9.294017	10.705983	10.008251	10.714234	52
9	9.286408	9.991724	9.294684	10.705316	10.008276	10.713592	51
10	9 287048	9.991699	9 295349	10.704651	10.008301	10.712952	50
11	9.287688	9.991674	9.296013	10.703987	10.008326	10.712312	49
12	9 288326	9.991649	9.296677	10.703323	10.008351	10.711674	48
13	9.288964	9.991624	9.297339	10.702661	10.008376	10.711036	47
14	9.289600	9 991599	9.298001	10.701999	10.008401	10.710400	46
15	9 290236	9.991574	9.298662	10.701338	10.008426	10.709764	45
16	9.290870	9.991549	9.299322	10.700678	10.008451	10.709130	44
17	9.291504	9 991524	9.299980	10.700020	10.008476	10.708496	43
18	9.292137	9.991498	9.300638	10.699362	10.008502	10.707863	42
19	9.292768	9 991473	9 301295	10.698705	10.008527	10.707232	41
20	9.293399	9.991448	9.301951	10.698049	10.008552	10.706601	40
21	9.294029	9.991422	9.302607	10.697393	10.008578	10.705971	39
22	9.294658	9.991397	9.303261	10.696739	10.008603	10.705342	38
23	9.295286	9.991372	9.303914	10.696086	10.008628	10.704714	37
24	9 295913	9.991346	9.304567	10.695433	10.008654	10.704087	36
25	9.296539	9 991321	9.305218	10.694782	10.008679	10.703461	35
26	9.297164	9.991295	9.305869	10.694131	10.008705	10.702836	34
27	9.297788	9.991270	9.306519	10.693481	10.008730	10.702212	33
28	9.298412	9.991244	9.307168	10.692832	10.008756	10.701588	32
29	9.299034	9.991218	9.307815	10.692185	10.008782	10.700966	31
30	9.299655	9.991193	9.308463	10.691537	10.008807	10.700345	30
31	9.300276	9.991167	9.309109	10.690891	10.008833	10.699724	29
32	9 300895	9.991141	9 309754	10.690246	10.008859	10.699105	28
33	9.301514	9.991115	9.310398	10.689602	10.008885	10.698486	27
34	9.302132	9.991090	9.311042	10.688958	10.008910	10.697868	26
35	9 302748	9.991064	9.311685	10.688315	10.008936	10.697252	25
36	9.303364	9.991038	9.312327	10.687673	10.008962	10.696636	24
37	9.303979	9 991012	9.312967	10.687033	10.008988	10.696021	23
38	9.304593	9.990986	9.313608	10.686392	10.009014	10.695407	22
39	9.305207	9.990960	9.314247	10.685753	10.009040	10.694793	21
40	9.305819	9.990934	9.314885	10.685115	10.009066	10.694181	20
41	9.306430	9.990908	9.315523	10.684477	10.009092	10.693570	19
42	9.307041	9.990882	9.316159	10.683841	10.009118	10.692959	18
43	9.307650	9.990855	9.316795	10.683205	10.009145	10.692350	17
44	9 308259	9.990829	9.317430	10.682570	10.009171	10.691741	16
45	9.308867	9.990803	9.318064	10.681936	10.009197	10.691133	15
46	9.309474	9.990777	9.318697	10.681303	10.009223	10.690526	14
47	9 310080	9.990750	9.319329	10.680671	10.009250	10.689920	13
48	9.310685	9.990724	9.319961	10.680039	10.009276	10.689315	12
49	9.311289	9.990697	9.320592	10.679408	10.009303	10.688711	11
50	9.311893	9.990671	9.321222	10.678778	10.009329	10.688107	10
51	9.312495	9.990645	9.321851	10.678149	10.009355	10.687505	9
52	9 313097	9.990618	9.322479	10.677521	10.009382	10.686903	8
53	9.313698	9.990591	9.323106	10.676894	10.009409	10.686302	7
54	9.314297	9.990565	9.323733	10.676267	10.009435	10.685703	6
55	9 314897	9.990538	9.324358	10.675642	10.009462	10.685103	5
56	9.315495	9.990511	9.324983	10.675017	10.009489	10.684505	4
57	9.316092	9 990485	9.325607	10.674393	10.009515	10.683903	3
58	9.316689	9.990458	9.326231	10.673769	10.009542	10.683311	2
59	9.317284	9.990431	9.326853	10.673147	10.009569	10.682716	1
60	9.317879	9.990404	9.327475	10.672525	10.009596	10.682121	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

78 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

12 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.317879	9.990404	9.327474	10.672526	10.009596	10.682121	60
1	9.318473	9.990378	9.328095	10.671905	10.009622	10.681527	59
2	9.319066	9.990351	9.328715	10.671285	10.009649	10.680934	58
3	9.319658	9.990324	9.329334	10.670666	10.009676	10.680342	57
4	9.320249	9.990297	9.329953	10.670047	10.009703	10.679751	56
5	9.320840	9.990270	9.330570	10.669430	10.009730	10.679160	55
6	9.321430	9.990243	9 331187	10.668813	10.009757	10.678570	54
7	9.322019	9.990215	9.331803	10.668197	10.009785	10.677981	53
8	9.322607	9 990188	9.332418	10.667582	10.009812	10.677393	52
9	9.323194	9.990161	9.333033	10.666967	10.009839	10.676806	51
10	9.323780	9.990134	9.333646	10.666354	10.009866	10.676220	50
11	9.324366	9 990107	9.334259	10.665741	10.009893	10.675634	49
12	9.324950	9.990079	9.334871	10.665129	10.009921	10.675050	48
13	9.325534	9.990052	9.335482	10.664518	10.009948	10.674466	47
14	9.326117	9.990025	9.336093	10.663907	10.009975	10.673883	46
15	9.326700	9.989997	9.336702	10.663298	10.010003	10.673300	45
16	9.327281	9.989970	9.337311	10.662689	10.010030	10.672719	44
17	9.327862	9.989942	9.337919	10.662081	10.010058	10.672138	43
18	9.328442	9.989915	9.338527	10.661473	10.010085	10.671558	42
19	9.329021	9.989887	9.339133	10.660867	10.010113	10.670979	41
20	9.329599	9.989860	9.339739	10.660261	10.010140	10.670401	40
21	9.330176	9.989832	9.340344	10.659656	10.010168	10.669824	39
22	9.330753	9.989804	9.340948	10.659052	10.010196	10.669247	38
23	9.331329	9.989777	9.341552	10.658448	10.010223	10.668671	37
24	9.331903	9.989749	9.342155	10.657845	10.010251	10.668097	36
25	9.332478	9.989721	9.342757	10.657243	10.010279	10.667522	35
26	9.333051	9.989693	9.343358	10.656642	10.010307	10.666949	34
27	9.333624	9.989665	9.343958	10.656042	10.010335	10.666376	33
28	9 334195	9.989637	9.344558	10.655442	10.010363	10.665805	32
29	9.334767	9.989610	9.345157	10.654843	10.010390	10.665233	31
30	9.335337	9.989582	9.345755	10.654245	10.010418	10.664663	30
31	9.335906	9.989553	9.346353	10.653647	10.010447	10.664094	29
32	9.336475	9.989525	9.346949	10.653051	10.010475	10.663525	28
33	9.337043	9.989497	9.347545	10.652455	10.010503	10.662957	27
34	9.337610	9.989469	9.348141	10.651859	10.010531	10.662390	26
35	9.338176	9.989441	9.348735	10.651265	10.010559	10.661824	25
36	9.338742	9.989413	9.349329	10.650671	10.010587	10.661258	24
37	9.339307	9.989385	9.349922	10.650078	10.010615	10.660693	23
38	9.339871	9.989356	9.350514	10.649486	10.010644	10.660129	22
39	9.340434	9.989328	9.351106	10.648894	10.010672	10.659566	21
40	9.340996	9.989300	9.351697	10.648303	10.010700	10.659004	20
41	9.341558	9.989271	9.352287	10.647713	10.010729	10.658442	19
42	9.342119	9.989243	9.352876	10.647124	10.010757	10.657881	18
43	9.342679	9.989214	9.353465	10.646535	10.010786	10.657321	17
44	9.343239	9.989186	9 354053	10.645947	10.010814	10.656761	16
45	9.343797	9.989157	9.354640	10.645360	10.010843	10.656203	15
46	9.344355	9.989128	9.355227	10.644773	10.010872	10.655645	14
47	9.344912	9.989100	9.355813	10.644187	10.010900	10.655088	13
48	9.345469	9.989071	9.356398	10.643602	10.010929	10.654531	12
49	9.346024	9.989042	9.356982	10.643018	10.010958	10.653976	11
50	9.346579	9.989014	9.357566	10.642434	10.010986	19.653421	10
51	9.347134	9.988985	9.358149	10.641851	10.011015	10.652866	9
52	9.347687	9.988956	9.358731	10.641269	10.011044	10.652313	8
53	9.348240	9.988927	9.359313	10.640687	10.011073	10.651760	7
54	9.348792	9.988898	9.359893	10.640107	10.011102	10.651208	6
55	9.349343	9.988869	9.360474	10.639526	10.011131	10.650657	5
56	9.349893	9.988840	9.361053	10.638947	10.011160	10.650107	4
57	9.350443	9.988811	9.361632	10.638368	10.011189	10.649557	3
58	9.350992	9.988782	9.362210	10.637790	10.011218	10.649008	2
59	9.351540	9.988753	9.362787	10.637213	10.011247	10.648460	1
60	9.352088	9.988724	9.363364	10.636636	10.011276	10.647912	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

77 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

13 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.352088	9.988724	9.363364	10.636636	10.011276	10.647912	60
1	9.352635	9.988695	9.363940	10.636060	10.011305	10.647365	59
2	9.353181	9.988666	9.364515	10.635485	10.011334	10.646819	58
3	9.353726	9.988636	9.365090	10.634910	10.011364	10.646274	57
4	9.354271	9.988607	9.365664	10.634336	10.011393	10.645729	56
5	9.354815	9.988578	9.366237	10.633763	10.011422	10.645185	55
6	9.355358	9.988548	9.366810	10.633190	10.011452	10.644642	54
7	9.355901	9.988519	9.367382	10.632618	10.011481	10.644099	53
8	9.356443	9.988489	9.367953	10.632047	10.011511	10.643557	52
9	9.356984	9.988460	9.368524	10.631476	10.011540	10.643016	51
10	9.357524	9.988430	9.369094	10.630906	10.011570	10.642476	50
11	9.358064	9.988401	9.369663	10.630337	10.011599	10.641936	49
12	9.358603	9.988371	9.370232	10.629768	10.011629	10.641397	48
13	9.359141	9.988342	9.370799	10.629201	10.011658	10.640859	47
14	9.359678	9.988312	9.371367	10.628633	10.011688	10.640322	46
15	9.360215	9.988282	9.371933	10.628067	10.011718	10.639785	45
16	9.360752	9.988252	9.372499	10.627501	10.011748	10.639248	44
17	9.361287	9.988223	9.373064	10.626936	10.011777	10.638713	43
18	9 361822	9.988193	9.373629	10.626371	10.011807	10.638178	42
19	9.362356	9 988163	9.374193	10.625807	10 011837	10.637644	41
20	9.362889	9 988133	9.374756	10.625244	10.011867	10.637111	40
21	9.363422	9.988103	9.375319	10.624681	10.011897	10.636578	39
22	9.363954	9.988073	9.375881	10.624119	10.011927	10.636046	38
23	9.364485	9.988043	9.376442	10.623558	10.011957	10.635515	37
24	9.365016	9.988013	9.377003	10.622997	10.011987	10.634984	36
25	9.365546	9.987983	9 377563	10.622437	10.012017	10.634454	35
26	9.366075	9.987953	9.378122	10.621878	10.012047	10.633925	34
27	9.366604	9.987922	9 378681	10.621319	10.012078	10.633396	33
28	9 367131	9.987892	9.379239	10.620761	10.012108	10.632869	32
29	9.367659	9.987862	9.379797	10.620203	10.012138	10.632341	31
30	9 368185	9.987832	9.380354	10.619646	10.012168	10.631815	30
31	9.368711	9.987801	9.380910	10.619090	10.012199	10 631289	29
32	9.369236	9.987771	9.381466	10.618534	10.012229	10.630764	28
33	9.369761	9.987740	9.382020	10.617980	10.012260	10.630239	27
34	9.370285	9.987710	9.382575	10.617425	10.012290	10.629715	26
35	9.370808	9.987679	9.383129	10.616871	10.012321	10.629192	25
36	9.371330	9.987649	9.383682	10.616318	10.012351	10.628670	24
37	9.371852	9.987618	9.384234	10.615766	10.012382	10.628148	23
38	9.372373	9 987588	9.384786	10.615214	10.012412	10.627627	22
39	9.372894	9.987557	9.385337	10.614663	10.012443	10.627106	21
40	9.373414	9.987526	9.385888	10.614112	10.012474	10.626586	20
41	9 373933	9.987496	9.386438	10.613562	10.012504	10.626067	19
42	9.374452	9.987465	9.386987	10.613013	10.012535	10.625548	18
43	9 374970	9.987434	9.387586	10.612464	10.012566	10.625030	17
44	9.375487	9.987403	9.388084	10.611916	10.012597	10.624513	16
45	9.376003	9.987372	9.388631	10.611369	10.012628	10.623997	15
46	9.376519	9.987341	9.389178	10.610822	10.012659	10.623481	14
47	9.377035	9.987310	9.389724	10.610276	10.012690	10.622965	13
48	9.377549	9.987279	9.390270	10.609730	10.012721	10.622451	12
49	9.378063	9.987248	9.390815	10.609185	10.012752	10.621937	11
50	9.378577	9.987217	9.391360	10.608640	10.012783	10.621423	10
51	9.379089	9.987186	9.391903	10.608097	10.012814	10.620911	9
52	9.379601	9.987155	9.392447	10.607553	10.012845	10.620399	8
53	9.380113	9.987124	9.392989	10.607011	10.012876	10.619887	7
54	9.380624	9.987092	9.393531	10.606469	10.012908	10.619376	6
55	9.381134	9.987061	9.394073	10.605927	10.012939	10.618866	5
56	9.381643	9.987030	9.394614	10.605386	10.012970	10.618357	4
57	9.382152	9.986998	9.395154	10.604846	10.013002	10.617848	3
58	9.382661	9.986967	9.395694	10.604306	10.013033	10.617339	2
59	9.383168	9.986936	9.396233	10.603767	10.013064	10.616832	1
60	9.383675	9.986904	9 396771	10.603229	10.013096	10.616325	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

76 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

14 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.383675	9.986904	9.396771	10.603229	10.013096	10.616325	60
1	9.384182	9.986873	9.397309	10.602691	10.013127	10.615818	59
2	9.384687	9.986841	9.397846	10.602154	10.013159	10.615313	58
3	9.385192	9.986809	9.398383	10.601617	10.013191	10.614808	57
4	9.385697	9.986778	9.398919	10.601081	10.013222	10.614303	56
5	9.386201	9.986746	9.399455	10.600545	10.013254	10.613799	55
6	9.386704	9.986714	9.399990	10.600010	10.013286	10.613296	54
7	9.387207	9.986683	9.400524	10.599476	10.013317	10.612793	53
8	9.387709	9.986651	9.401058	10.598942	10.013349	10.612291	52
9	9.388210	9.986619	9.401591	10.598409	10.013381	10.611790	51
10	9.388711	9.986587	9.402124	10.597876	10.013413	10.611289	50
11	9.389211	9.986555	9.402656	10.597344	10.013445	10.610789	49
12	9.389711	9.986523	9.403187	10.596813	10.013477	10.610289	48
13	9.390210	9.986491	9.403718	10.596282	10.013509	10.609790	47
14	9.390708	9.986459	9.404249	10.595751	10.013541	10.609292	46
15	9.391206	9.986427	9.404778	10.595222	10.013573	10 608794	45
16	9.391703	9.986395	9.405308	10.594692	10.013605	10.608297	44
17	9.392199	9.986363	9.405836	10.594164	10.013637	10.607801	43
18	9.392695	9.986331	9.406364	10.593636	10.013669	10.607305	42
19	9.393191	9.986299	9.406892	10.593108	10.013701	10.606810	41
20	9.393685	9.986266	9.407419	10.592581	10.013734	10.606315	40
21	9.394179	9.986234	9.407945	10.592055	10.013766	10.605821	39
22	9.394673	9.986202	9.408471	10.591529	10.013798	10.605327	38
23	9.395166	9.986169	9.408997	10.591003	10.013831	10.604834	37
24	9.395658	9.986137	9.409521	10.590479	10.013863	10.604342	36
25	9.396150	9.986104	9.410045	10.589955	10.013896	10.603850	35
26	9.396641	9.986072	9.410569	10.589431	10.013928	10.603359	34
27	9.397132	9.986039	9.411092	10.588908	10.013961	10.602868	33
28	9.397621	9 986007	9.411615	10.588385	10.013993	10.602379	32
29	9.398111	9.985974	9.412137	10.587863	10.014026	10.601889	31
30	9.398600	9.985942	9.412658	10.587342	10.014058	10.601400	30
31	9.399088	9.985909	9.413179	10.586821	10.014091	10.600912	29
32	9.399575	9.985876	9.413699	10.586301	10.014124	10.600425	28
33	9.400062	9.985843	9.414219	10.585781	10.014157	10.599938	27
34	9.400549	9.985811	9.414738	10.585262	10.014189	10.599451	26
35	9.401035	9.985778	9.415257	10.584743	10.014222	10.598965	25
36	9.401520	9.985745	9.415775	10.584225	10.014255	10.598480	24
37	9.402005	9.985712	9.416293	10.583707	10.014288	10.597995	23
38	9.402489	9.985679	9.416810	10.583190	10.014321	10.597511	22
39	9.402972	9.985646	9.417326	10.582674	10.014354	10.597028	21
40	9.403455	9.985613	9.417842	10.582158	10.014387	10.596545	20
41	9.403938	9.985580	9.418358	10.581642	10.014420	10.596062	19
42	9.404420	9.985547	9 418873	10.581127	10.014453	10.595580	18
43	9.404901	9.985514	9.419387	10.580613	10.014486	10.595099	17
44	9.405382	9.985480	9 419901	10.580099	10.014520	10.594618	16
45	9.405862	9 985447	9.420415	10.579585	10.014553	10.594138	15
46	9.406341	9.985414	9 420927	10.579073	10.014586	10.593659	14
47	9.406820	9.985381	9.421440	10.578560	10.014619	10.593180	13
48	9.407299	9.985347	9.421952	10.578048	10.014653	10.592701	12
49	9.407777	9.985314	9.422463	10.577537	10.014686	10.592223	11
50	9.408254	9.985280	9.422974	10.577026	10.014720	10.591746	10
51	9.408731	9.985247	9.423484	10.576516	10.014753	10.591269	9
52	9.409207	9.985213	9.423993	10.576007	10.014787	10.590793	8
53	9.409682	9.985180	9.424503	10.575497	10.014820	10.590318	7
54	9.410157	9.985146	9.425011	10.574989	10.014854	10.589843	6
55	9.410632	9.985113	9.425519	10.574481	10.014887	10.589368	5
56	9.411106	9.985079	9.426027	10.573973	10.014921	10.588894	4
57	9.411579	9.985045	9.426534	10.573466	10.014955	10.588421	3
58	9.412052	9.985011	9.427041	10.572959	10.014989	10.587948	2
59	9.412524	9.984978	9.427547	10.572453	10.015022	10.587476	1
60	9.412993	9 984944	9.428052	10.571948	10.015056	10.587004	0
M	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

75 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

15 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.412996	9.984944	9.428052	10.571948	10.015056	10.587004	60
1	9.413467	9.984910	9.428557	10.571443	10.015090	10.586533	59
2	9.413938	9.984876	9.429062	10.570938	10.015124	10.586062	58
3	9.414408	9.984842	9.429566	10.570434	10.015158	10.585592	57
4	9.414878	9.984808	9.430070	10.569930	10.015192	10.585122	56
5	9.415347	9.984774	9.430573	10.569427	10.015226	10.584653	55
6	9.415815	9.984740	9.431075	10.568925	10.015260	10.584185	54
7	9.416283	9.984706	9.431577	10.568423	10.015294	10.583717	53
8	9.416751	9.984672	9.432079	10.567921	10.015328	10.583249	52
9	9.417217	9.984638	9.432580	10.567420	10.015362	10.582783	51
10	9.417684	9.984603	9.433080	10.566920	10.015397	10.582316	50
11	9.418150	9.984569	9.433580	10.566420	10.015431	10.581850	49
12	9.418615	9.984535	9.434080	10.565920	10.015465	10.581385	48
13	9.419079	9.984500	9.434579	10.565421	10.015500	10.580921	47
14	9.419544	9.984466	9.435078	10.564922	10.015534	10.580456	46
15	9.420007	9.984432	9.435576	10.564424	10.015568	10.579993	45
16	9.420470	9.984397	9.436073	10.563927	10.015603	10.579530	44
17	9.420933	9.984363	9.436570	10.563430	10.015637	10.579067	43
18	9.421395	9.984328	9.437067	10.562933	10.015672	10.578605	42
19	9.421857	9.984294	9.437563	10.562437	10.015706	10.578143	41
20	9.422318	9.984259	9.438059	10.561941	10.015741	10.577682	40
21	9.422778	9.984224	9.438554	10.561446	10.015776	10.577222	39
22	9.423238	9.984190	9.439048	10.560952	10.015810	10.576762	38
23	9.423697	9.984155	9.439543	10.560457	10.015845	10.576303	37
24	9.424156	9.984120	9.440036	10.559964	10.015880	10.575844	36
25	9.424615	9.984085	9.440529	10.559471	10.015915	10.575385	35
26	9.425073	9.984050	9.441022	10.558978	10.015950	10.574927	34
27	9.425530	9.984015	9.441514	10.558486	10.015985	10.574470	33
28	9.425987	9.983981	9.442006	10.557994	10.016019	10.574013	32
29	9.426443	9.983946	9.442497	10.557503	10.016054	10.573557	31
30	9.426899	9.983911	9.442988	10.557012	10.016089	10.573101	30
31	9.427354	9.983875	9.443479	10.556521	10.016125	10.572646	29
32	9.427809	9.983840	9.443968	10.556032	10.016160	10.572191	28
33	9.428263	9.983805	9.444458	10.555542	10.016195	10.571737	27
34	9.428717	9.983770	9.444947	10.555053	10.016230	10.571283	26
35	9.429170	9.983735	9.445435	10.554565	10.016265	10.570830	25
36	9.429623	9.983700	9.445923	10.554077	10.016300	10.570377	24
37	9.430075	9.983664	9.446411	10.553589	10.016336	10.569925	23
38	9.430527	9.983629	9.446898	10.553102	10.016371	10.569473	22
39	9.430978	9.983594	9.447384	10.552616	10.016406	10.569022	21
40	9.431429	9.983558	9.447870	10.552130	10.016442	10.568571	20
41	9.431879	9.983523	9.448356	10.551644	10.016477	10.568121	19
42	9.432329	9.983487	9.448841	10.551159	10.016513	10.567671	18
43	9.432778	9.983452	9.449326	10.550674	10.016548	10.567222	17
44	9.433226	9.983416	9.449810	10.550190	10.016584	10.566774	16
45	9.433675	9.983381	9.450294	10.549706	10.016619	10.566325	15
46	9.434122	9.983345	9.450777	10.549223	10.016655	10.565878	14
47	9.434569	9.983309	9.451260	10.548740	10.016691	10.565431	13
48	9.435016	9.983273	9.451743	10.548257	10.016727	10.564984	12
49	9.435462	9.983238	9.452225	10.547775	10.016762	10.564538	11
50	9.435908	9.983202	9.452706	10.547294	10.016798	10.564092	10
51	9.436353	9.983166	9.453187	10.546813	10.016834	10.563647	9
52	9.436798	9.983130	9.453668	10.546332	10.016870	10.563202	8
53	9.437242	9.983094	9.454148	10.545852	10.016906	10.562758	7
54	9.437686	9.983058	9.454628	10.545372	10.016942	10.562314	6
55	9.438129	9.983022	9.455107	10.544893	10.016978	10.561871	5
56	9.438572	9.982986	9.455586	10.544414	10.017014	10.561428	4
57	9.439014	9.982950	9.456064	10.543936	10.017050	10.560986	3
58	9.439456	9.982914	9.456542	10.543458	10.017086	10.560544	2
59	9.439897	9.982878	9.457019	10.542981	10.017122	10.560103	1
60	9.440338	9.982842	9.457496	10.542504	10.017158	10.559662	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

74 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

16 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.440338	9.982842	9.457496	10.542504	10.017158	10.559662	60
1	9.440778	9.982805	9.457973	10.542027	10.017195	10.559222	59
2	9 441218	9.982769	9.458449	10.541551	10.017231	10.558782	58
3.	9.441658	9.982733	9.458925	10.541075	10.017267	10.558342	57
4	9 442096	9 982696	9.459400	10.540600	10.017304	10.557904	56
5	9.442535	9.982660	9 459875	10.540125	10 017340	10.557465	55
6	9.442973	9.982624	9.460349	10.539651	10.017376	10.557027	54
7	9.443410	9.982587	9.460823	10.539177	10.017413	10.556590	53
8	9.443847	9.982551	9.461297	10.538703	10.017449	10.556153	52
9	9.444284	9.982514	9.461770	10.538230	10.017486	10.555716	51
10	9.444720	9.982477	9.462242	10.537758	10.017523	10.555280	50
11	9.445155	9.982441	9.462714	10.537286	10.017559	10.554845	49
12	9.445590	9.982404	9.463186	10.536814	10.017596	10.554410	48
13	9.446025	9.982367	9.463658	10.536342	10.017633	10.553975	47
14	9.446459	9.982331	9 464128	10.535872	10.017669	10.553541	46
15	9.446893	9.982294	9.464599	10.535401	10.017706	10.553107	45
16	9.447326	9.982257	9 465069	10.534931	10.017743	10.552674	44
17	9.447759	9.982220	9.465539	10.634461	10.017780	10.552241	43
18	9.448191	9.982183	9 466008	10.533992	10.017817	10.551809	42
19	9.448623	9.982146	9.466476	10.533524	10.017854	10.551377	41
20	9.449054	9.982109	9 466945	10.533055	10.017891	10.550946	40
21	9.449485	9.982072	9.467413	10.532587	10.017928	10.550515	39
22	9.449915	9.982035	9.467880	10.532120	10.017965	10.550085	38
23	9.450345	9.981998	9.468347	10.531653	10.018002	10.549655	37
24	9.450775	9.981961	9.468814	10.531186	10.018039	10.549225	36
25	9.451204	9.981924	9.469280	10.530720	10.018076	10.548796	35
26	9.451632	9.981886	9 469746	10.530254	10.018114	10.548368	34
27	9.452060	9.981849	9.470211	10.529789	10.018151	10.547940	33
28	9.452488	9.981812	9 470676	10.529324	10.018188	10.547512	32
29	9.452915	9.981774	9.471141	10.528859	10.018226	10.547085	31
30	9.453342	9.981737	9.471605	10.528395	10.018263	10.546658	30
31	9.453768	9.981700	9.472068	10.527932	10.018300	10.546232	29
32	9.454194	9.981662	9.472532	10.527468	10.018338	10.545806	28
33	9.454619	9.981625	9.472995	10.527005	10.018375	10.545381	27
34	9.455044	9.981587	9.473457	10.526543	10.018413	10.544956	26
35	9.455469	9.981549	9.473919	10.526081	10.018451	10.544531	25
36	9.455893	9.981512	9.474381	10.525619	10.018488	10.544107	24
37	9.456316	9 981474	9.474842	10.525158	10.018526	10.543684	23
38	9.456739	9.981436	9.475303	10.524697	10.018564	10.543261	22
39	9.457162	9.981399	9.475763	10.524237	10.018601	10.542838	21
40	9.457584	9.981361	9.476223	10.523777	10.018639	10.542416	20
41	9.458006	9.981323	9 476683	10.523317	10.018677	10.541994	19
42	9.458427	9 981285	9.477142	10.522858	10.018715	10.541573	18
43	9.458848	9.981247	9.477601	10.522399	10.018753	10.541152	17
44	9.459268	9.981209	9.478059	10.521941	10.018791	10.540732	16
45	9.459688	9.981171	9.478517	10.521483	10.018829	10.540312	15
46	9.460108	9.981133	9 478975	10.521025	10.018867	10.539892	14
47	9.460527	9.981095	9.479432	10.520568	10.018905	10.539473	13
48	9.460946	9.981057	9.479889	10.520111	10.018943	10.539054	12
49	9.461364	9.981019	9.480345	10.519655	10.018981	10.538636	11
50	9 461782	9.980981	9 480801	10.519199	10.019019	10.538218	10
51	9.462199	9.980942	9.481257	10.518743	10.019058	10.537801	9
52	9.462616	9 980904	9.481712	10.518288	10.019096	10.537384	8
53	9.463032	9.980866	9.482167	10.517833	10.019134	10.536968	7
54	9.463448	9.980827	9.482621	10.517379	10.019173	10.536552	6
55	9.463864	9.980789	9.483075	10.516925	10.019211	10.536136	5
56	9.464279	9.980750	9.483529	10.516471	10.019250	10.535721	4
57	9.464694	9.980712	9 483982	10.516018	10.019288	10.535306	3
58	9.465108	9.980673	9.484435	10.515565	10.019327	10.534892	2
59	9.465522	9.980635	9.484887	10.515113	10.019365	10.534478	1
60	9.465935	9.980596	9.485339	10.514661	10.019404	10.534065	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

73 Degrees.

TABLE II.

LOGARITHMIC SIGNS, TANGENTS AND SECANTS.

17 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.465935	9.980596	9.485339	10.514661	10.019404	10.534065	60
1	9.466348	9.980558	9.485791	10.514209	10.019442	10.533652	59
2	9.466761	9.980519	9.486242	10.513758	10.019481	10.533239	58
3	9.467173	9.980480	9.486693	10.513307	10.019520	10.532827	57
4	9.467585	9.980442	9.487143	10.512857	10.019558	10.532415	56
5	9.467996	9.980403	9.487593	10.512407	10.019597	10.532004	55
6	9.468407	9.980364	9.488043	10.511957	10.019636	10.531593	54
7	9.468817	9.980325	9.488492	10.511508	10.019675	10.531183	53
8	9.469227	9.980286	9.488941	10.511059	10.019714	10.530773	52
9	9.469637	9.980247	9.489390	10.510610	10.019753	10.530363	51
10	9.470046	9.980208	9.489838	10.510162	10.019792	10.529954	50
11	9.470455	9.980169	9.490286	10.509714	10.019831	10.529545	49
12	9.470863	9.980130	9.490733	10.509267	10.019870	10.529137	48
13	9.471271	9.980091	9.491180	10.508820	10.019909	10.528729	47
14	9.471679	9.980052	9.491627	10.508373	10.019948	10.528321	46
15	9.472086	9.980012	9.492073	10.507927	10.019988	10.527914	45
16	9.472492	9.979973	9.492519	10.507481	10.020027	10.527508	44
17	9.472898	9.979934	9.492965	10.507035	10.020066	10.527102	43
18	9.473304	9.979895	9.493410	10.506590	10.020105	10.526696	42
19	9.473710	9.979855	9.493854	10.506146	10.020145	10.526290	41
20	9.474115	9.979816	9.494299	10.505701	10.020184	10.525885	40
21	9.474519	9.979776	9.494743	10.505257	10.020224	10.525481	39
22	9.474923	9.979737	9.495186	10.504814	10.020263	10.525077	38
23	9.475327	9.979697	9.495630	10.504370	10.020303	10.524673	37
24	9.475730	9.979658	9.496073	10.503927	10.020342	10.524270	36
25	9.476133	9.979618	9.496515	10.503485	10.020382	10.523867	35
26	9.476536	9.979579	9.496957	10.503043	10.020421	10.523464	34
27	9.476938	9.979539	9.497399	10.502601	10.020461	10.523062	33
28	9.477340	9.979499	9.497841	10.502159	10.020501	10.522660	32
29	9.477741	9.979459	9.498282	10.501718	10.020541	10.522259	31
30	9.478142	9.979420	9.498722	10.501278	10.020580	10.521858	30
31	9.478542	9.979380	9.499163	10.500837	10.020620	10.521458	29
32	9.478942	9.979340	9.499603	10.500397	10.020660	10.521058	28
33	9.479342	9.979300	9.500042	10.499958	10.020700	10.520658	27
34	9.479741	9.979260	9.500481	10.499519	10.020740	10.520259	26
35	9.480140	9.979220	9.500920	10.499080	10.020780	10.519860	25
36	9.480539	9.979180	9.501359	10.498641	10.020820	10.519461	24
37	9.480937	9.979140	9.501797	10.498203	10.020860	10.519063	23
38	9.481334	9.979100	9.502235	10.497765	10.020900	10.518666	22
39	9.481731	9.979059	9.502672	10.497328	10.020941	10.518269	21
40	9.482128	9.979019	9.503109	10.496891	10.020981	10.517872	20
41	9.482525	9.978979	9.503546	10.496454	10.021021	10.517475	19
42	9.482921	9.978939	9.503982	10.496018	10.021061	10.517079	18
43	9.483316	9.978898	9.504418	10.495582	10.021102	10.516684	17
44	9.483712	9.978858	9.504854	10.495146	10.021142	10.516288	16
45	9.484107	9.978817	9.505289	10.494711	10.021183	10.515893	15
46	9.484501	9.978777	9.505724	10.494276	10.021223	10.515499	14
47	9.484895	9.978737	9.506159	10.493841	10.021263	10.515105	13
48	9.485289	9.978696	9.506593	10.493407	10.021304	10.514711	12
49	9.485682	9.978655	9.507027	10.492973	10.021345	10.514318	11
50	9.486075	9.978615	9.507460	10.492540	10.021385	10.513925	10
51	9.486467	9.978574	9.507893	10.492107	10.021426	10.513533	9
52	9.486860	9.978533	9.508326	10.491674	10.021467	10.513140	8
53	9.487251	9.978493	9.508759	10.491241	10.021507	10.512749	7
54	9.487643	9.978452	9.509191	10.490809	10.021548	10.512357	6
55	9.488034	9.978411	9.509622	10.490378	10.021589	10.511966	5
56	9.488424	9.978370	9.510054	10.489946	10.021630	10.511576	4
57	9.488814	9.978329	9.510485	10.489515	10.021671	10.511186	3
58	9.489204	9.978288	9.510916	10.489084	10.021712	10.510796	2
59	9.489593	9.978247	9.511346	10.488654	10.021753	10.510407	1
60	9.489982	9.978206	9.511776	10.488224	10.021794	10.510018	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

72 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

18 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.489982	9.978206	9.511776	10.488224	10.021794	10.510018	60
1	9.490371	9.978165	9.512206	10.487794	10.021835	10.509629	59
2	9.490759	9.978124	9.512635	10.487365	10.021876	10.509241	58
3	9.491147	9.978083	9.513064	10.486936	10.021917	10.508853	57
4	9 491535	9.978042	9.513493	10.486507	10.021958	10.508465	56
5	9.491922	9.978001	9.513921	10.486079	10.021999	10.508078	55
6	9.492308	9.977959	9.514349	10.485651	10.022041	10.507692	54
7	9.492695	9.977918	9.514777	10.485223	10.022082	10.507305	53
8	9.493081	9.977877	9.515204	10.484796	10.022123	10.506919	52
9	9.493466	9.977835	9.515631	10.484369	10.022165	10.506534	51
10	9.493851	9.977794	9.516057	10.483943	10.022206	10.506149	50
11	9.494236	9 977752	9.516484	10.483516	10.022248	10.505764	49
12	9.494621	9.977711	9.516910	10.483090	10.022289	10.505379	48
13	9.495005	9.977669	9.517335	10.482665	10.022331	10.504995	47
14	9.495388	9.977628	9.517761	10.482239	10.022372	10.504612	46
15	9.495772	9.977586	9.518185	10.481815	10.022414	10.504228	45
16	9.496154	9.977544	9.518610	10.481390	10.022456	10.503846	44
17	9.496537	9.977503	9.519034	10.480966	10.022497	10.503463	43
18	9.496919	9.977461	9.519458	10.480542	10.022539	10.503081	42
19	9.497301	9.977419	9.519882	10.480118	10.022581	10.502699	41
20	9.497682	9.977377	9.520305	10 479695	10.022623	10.502318	40
21	9 498064	9.977335	9.520728	10.479272	10.022665	10.501936	39
22	9.498444	9.977293	9.521151	10.478849	10.022707	10.501556	38
23	9.498825	9.977251	9.521573	10.478427	10.022749	10.501175	37
24	9.499204	9.977209	9.521995	10.478005	10.022791	10.500796	36
25	9.499584	9.977167	9.522417	10.477583	10.022833	10.500416	35
26	9.499963	9.977125	9.522838	10.477162	10.022875	10.500037	34
27	9.500342	9.977083	9.523259	10.476741	10.022917	10.499658	33
28	9 500721	9.977041	9.523680	10.476320	10.022959	10.499279	32
29	9.501099	9.976999	9.524100	10.475900	10.023001	10.498901	31
30	9.501476	9.976957	9.524520	10.475480	10.023043	10.498524	30
31	9.501854	9.976914	9.524939	10.475061	10.023086	10.498146	29
32	9.502231	9.976872	9.525359	10.474641	10.023128	10.497769	28
33	9.502607	9.976830	9.525778	10.474222	10.023170	10.497393	27
34	9.502984	9.976787	9.526197	10.473803	10.023213	10.497016	26
35	9.503360	9.976745	9.526615	10.473385	10.023255	10.496640	25
36	9.503735	9.976702	9.527033	10.472967	10.023298	10.496265	24
37	9.504110	9.976660	9.527451	10.472549	10.023340	10.495890	23
38	9.504485	9.976617	9.527868	10.472132	10.023383	10.495515	22
39	9.504860	9.976574	9.528285	10.471715	10.023426	10.495140	21
40	9.505234	9.976532	9.528702	10.471298	10.023468	10.494766	20
41	9.505608	9.976489	9 529119	10.470881	10.023511	10.494392	19
42	9.505981	9.976446	9.529535	10.470465	10.023554	10.494019	18
43	9.506354	9.976404	9 529950	10.470050	10.023596	10.493646	17
44	9.506727	9.976361	9 530366	10.469634	10.023639	10.493273	16
45	9.507099	9.976318	9.530781	10.469219	10.023682	10.492901	15
46	9.507471	9.976275	9.531196	10.468804	10.023725	10.492529	14
47	9.507843	9.976232	9.531611	10.468389	10.023768	10.492157	13
48	9.508214	9.976189	9.532025	10.467975	10.023811	10.491786	12
49	9.508585	9.976146	9.532439	10.467561	10.023854	10.491415	11
50	9.508956	9.976103	9.532853	10.467147	10.023897	10.491044	10
51	9.509326	9.976060	9.533266	10.466734	10.023940	10.490674	9
52	9.509696	9.976017	9.533679	10.466321	10.023983	10.490304	8
53	9.510065	9.975974	9.534092	10.465908	10.024026	10.489935	7
54	9.510434	9.975930	9.534504	10.465496	10.024070	10.489566	6
55	9.510803	9.975887	9.534916	10.465084	10.024113	10.489197	5
56	9.511172	9.975844	9.535328	10.464672	10.024156	10.488828	4
57	9.511540	9.975800	9.535739	10.464261	10.024200	10.488460	3
58	9.511907	9.975757	9.536150	10.463850	10.024243	10.488093	2
59	9.512275	9.975714	9.536561	10.463439	10.024286	10.487725	1
60	9.512642	9.975670	9.536972	10.463028	10.024330	10.487358	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

71 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

19 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.512642	9.975670	9.536972	10 463028	10.024330	10.487358	60
1	9.513009	9.975627	9.537382	10.462618	10.024373	10.486991	59
2	9.513375	9.975583	9.537792	10.462208	10.024417	10.486625	58
3	9.513741	9.975539	9.538202	10.461798	10.024461	10.486259	57
4	9.514107	9.975496	9.538611	10.461389	10.024504	10.485893	56
5	9.514472	9.975452	9.539020	10.460980	10.024548	10.485528	55
6	9.514837	9.975408	9.539429	10.460571	10.024592	10.485163	54
7	9.515202	9.975365	9.539837	10.460163	10.024635	10.484798	53
8	9.515566	9.975321	9.540245	10.459755	10.024679	10.484434	52
9	9.515930	9.975277	9.540653	10.459347	10.024723	10.484070	51
10	9.516294	9.975233	9 541061	10.458939	10.024767	10.483706	50
11	9.516657	9.975189	9.541468	10.458532	10.024811	10.483343	49
12	9.517020	9.975145	9.541875	10.458125	10.024855	10.482980	48
13	9.517382	9.975101	9.542281	10.457719	10.024899	10.482618	47
14	9.517745	9.975057	9.542688	10.457312	10.024943	10.482255	46
15	9 518107	9.975013	9.543094	10.456906	10.024987	10.481893	45
16	9.518468	9.974969	9.543499	10.456501	10.025031	10.481532	44
17	9.518829	9.974925	9.543905	10.456095	10.025075	10.481171	43
18	9.519190	9.974880	9.544310	10.455690	10.025120	10.480810	42
19	9.519551	9.974836	9.544715	10.455285	10.025164	10.480449	41
20	9.519911	9.974792	9.545119	10.454881	10.025208	10.480089	40
21	9.520271	9.974748	9.545524	10.454476	10.025252	10.479729	39
22	9.520634	9.974703	9.545928	10.454072	10.025297	10.479369	38
23	9.520990	9.974659	9.546331	10.453669	10.025341	10.479010	37
24	9 521349	9.974614	9.546735	10.453265	10.025386	10.478651	36
25	9.521707	9 974570	9.547138	10.452862	10.025430	10.478293	35
26	9.522066	9.974525	9.547540	10.452460	10.025475	10.477934	34
27	9.522424	9.974481	9.547943	10.452057	10.025519	10.477576	33
28	9.522781	9.974436	9.548345	10.451655	10.025564	10.477219	32
29	9.523138	9.974391	9.548747	10.451253	10.025609	10.476862	31
30	9.523495	9.974347	9.549149	10.450851	10.025653	10.476505	30
31	9.523852	9.974302	9.549550	10.450450	10.025698	10.476148	29
32	9 524208	9.974257	9.549951	10.450049	10.025743	10.475792	28
33	9.524564	9.974212	9.550352	10.449648	10.025788	10.475436	27
34	9.524920	9.974167	9.550752	10.449248	10.025833	10.475080	26
35	9 525275	9.974122	9.551152	10.448848	10.025878	10.474725	25
36	9.525630	9.974077	9.551552	10.448448	10.025923	10.474370	24
37	9.525984	9 974032	9.551952	10.448048	10.025968	10.474016	23
38	9.526339	9.973987	9.552351	10.447649	10.026013	10.473661	22
39	9.526693	9.973942	9.552750	10.447250	10.026058	10.473307	21
40	9.527046	9.973897	9.553149	10.446851	10.026103	10.572954	20
41	9.527400	9.973852	9.553548	10.446452	10.026148	10.472600	19
42	9.527753	9.973807	9.553946	10.446054	10.026193	10.472247	18
43	9.528105	9.973761	9.554344	10.445656	10.026239	10.471895	17
44	9.528458	9.973716	9.554741	10.445259	10.026284	10.471542	16
45	9.528810	9.973671	9.555139	10.444861	10.026329	10.471190	15
46	9.529161	9.973625	9.555536	10.444464	10.026375	10.470839	14
47	9 529513	9.973580	9.555933	10.444067	10.026420	10.470487	13
48	9.529864	9.973535	9.556329	10.443671	10.026465	10.470136	12
49	9.530215	9.973489	9.556725	10.443275	10.026511	10.469785	11
50	9.530565	9.973444	9.557121	10.442879	10.026556	10.469435	10
51	9.530915	9.973398	9.557517	10.442483	10.026602	10.469085	9
52	9.531265	9.973352	9.557913	10.442087	10.026648	10.468735	8
53	9.531614	9.973307	9.558308	10.441692	10.026693	10.468386	7
54	9.531963	9.973261	9.558702	10.441298	10.026739	10.468037	6
55	9 532312	9.973215	9.559097	10.440903	10.026785	10.467688	5
56	9.532661	9.973169	9.559491	10.440509	10.026831	10.467339	4
57	9.533009	9.973124	9.559885	10.440115	10.026876	10.466991	3
58	9.533357	9.973078	9.560279	10.439721	10.026922	10.466643	2
59	9.533704	9.973032	9.560673	10.439327	10.026968	10.466296	1
60	9.534052	9.972986	9.561066	10.438934	10.027014	10.465948	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

70 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

20 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.534052	9.972986	9.561066	10.438934	10.027014	10.465948	60
1	9.534399	9.972940	9.561459	10.438541	10.027060	10.465601	59
2	9.534745	9.972894	9.561851	10.438149	10.027106	10.465255	58
3	9.535092	9.972848	9.562244	10.437756	10.027152	10.464908	57
4	9.535438	9.972802	9.562636	10.437364	10.027198	10.464562	56
5	9.535783	9.972755	9.563028	10.436972	10.027245	10.464217	55
6	9.536129	9.972709	9.563419	10.436581	10.027291	10.463871	54
7	9.536474	9.972663	9.563811	10.436189	10.027337	10.463526	53
8	9.536818	9.972617	9.564202	10.435798	10.027383	10.463182	52
9	9.537163	9.972570	9.564592	10.435408	10.027430	10.462837	51
10	9.537507	9.972524	9.564983	10.435017	10.027476	10.462493	50
11	9.537851	9.972478	9.565373	10.434627	10.027522	10.462149	49
12	9.538194	9.972431	9.565763	10.434237	10.027569	10.461806	48
13	9.538538	9.972385	9.566153	10.433847	10.027615	10.461462	47
14	9.538880	9.972338	9.566542	10.433458	10.027662	10.461120	46
15	9.539223	9.972291	9.566932	10.433068	10.027709	10.460777	45
16	9.539565	9.972245	9.567320	10.432680	10.027755	10.460435	44
17	9.539907	9.972198	9.567709	10.432291	10.027802	10.460093	43
18	9.540249	9.972151	9.568098	10.431902	10.027849	10.459751	42
19	9.540590	9.972105	9.568486	10.431514	10.027895	10.459410	41
20	9.540931	9.972058	9.568873	10.431127	10.027942	10.459069	40
21	9.541272	9.972011	9.569261	10.430739	10.027989	10.458728	39
22	9.541613	9.971964	9.569648	10.430352	10.028036	10.458387	38
23	9.541953	9.971917	9.570035	10.429965	10.028083	10.458047	37
24	9.542293	9.971870	9.570422	10.429578	10.028130	10.457707	36
25	9.542632	9.971823	9.570809	10.429191	10.028177	10.457368	35
26	9.542971	9.971776	9.571195	10.428805	10.028224	10.457029	34
27	9.543310	9.971729	9.571581	10.428419	10.028271	10.456690	33
28	9.543649	9.971682	9.571967	10.428033	10.028318	10.456351	32
29	9.543987	9.971635	9.572352	10.427648	10.028365	10.456013	31
30	9.544325	9.971588	9.572738	10.427262	10.028412	10.455675	30
31	9.544663	9.971540	9.573123	10.426877	10.028460	10.455337	29
32	9.545000	9.971493	9.573507	10.426493	10.028507	10.455000	28
33	9.545338	9.971446	9.573892	10.426108	10.028554	10.454662	27
34	9.545674	9.971398	9.574276	10.425724	10.028602	10.454326	26
35	9.546011	9.971351	9.574660	10.425340	10.028649	10.453989	25
36	9.546347	9.971303	9.575044	10.424956	10.028697	10.453653	24
37	9.546683	9.971256	9.575427	10.424573	10.028744	10.453317	23
38	9.547019	9.971208	9.575810	10.424190	10.028792	10.452981	22
39	9.547354	9.971161	9.576193	10.423807	10.028839	10.452646	21
40	9.547689	9.971113	9.576576	10.423424	10.028887	10.452311	20
41	9.548024	9.971066	9.576958	10.423042	10.028934	10.451976	19
42	9.548359	9.971018	9 577341	10.422659	10.028982	10.451641	18
43	9.548693	9.970970	9.577723	10.422277	10.029030	10.451307	17
44	9.549027	9.970922	9.578104	10.421896	10.029078	10.450973	16
45	9.549360	9.970874	9.578486	10.421514	10.029126	10.450640	15
46	9.549693	9.970827	9 578867	10.421133	10.029173	10.450307	14
47	9.550026	9.970779	9.579248	10.420752	10.029221	10.449974	13
48	9.550359	9.970731	9.579629	10.420371	10.029269	10.449641	12
49	9.550692	9.970683	9.580009	10.419991	10.029317	10.449308	11
50	9.551024	9.970635	9.580389	10.419611	10.029365	10.448976	10
51	9.551356	9.970586	9.580769	10.419231	10.029414	10.448644	9
52	9.551687	9.970538	9.581149	10.418851	10.029462	10.448313	8
53	9.552018	9.970490	9.581528	10.418472	10.029510	10.447982	7
54	9.552349	9.970442	9.581907	10.418093	10.029558	10.447651	6
55	9.552680	9.970394	9.582286	10.417714	10.029606	10.447320	5
56	9.553010	9.970345	9.582665	10.417335	10.029655	10.446990	4
57	9.553341	9.970297	9.583043	10.416957	10.029703	10.446659	3
58	9.553670	9.970249	9.583422	10.416578	10.029751	10.446330	2
59	9.554000	9.970200	9.583800	10.416200	10.029800	10.446000	1
60	9.554329	9.970152	9.584177	10.415823	10.029848	10.445671	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

69 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

21 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.554329	9.970152	9.584177	10.415823	10.029848	10.445671	60
1	9.554658	9.970103	9.584555	10.415445	10.029897	10.445342	59
2	9.554987	9.970055	9.584932	10.415068	10.029945	10.445013	58
3	9.555315	9.970006	9.585309	10.414691	10.029994	10.444685	57
4	9.555643	9.969957	9.585686	10.414314	10.030043	10.444357	56
5	9.555971	9.969909	9.586062	10.413938	10.030091	10.444029	55
6	9.556299	9.969860	9.586439	10.413561	10.030140	10.443701	54
7	9.556626	9.969811	9.586815	10.413185	10.030189	10.443374	53
8	9.556953	9.969762	9.587190	10.412810	10.030238	10.443047	52
9	9.557280	9.969714	9.587566	10.412434	10.030286	10.442720	51
10	9.557606	9.969665	9.587941	10.412059	10.030335	10.442394	50
11	9.557932	9.969616	9.588316	10.411684	10.030384	10.442068	49
12	9.558258	9.969567	9.588691	10.411309	10.030433	10.441742	48
13	9.558583	9.969518	9.589066	10.410934	10.030482	10.441417	47
14	9.558909	9.969469	9.589440	10.410560	10.030531	10.441091	46
15	9.559234	9.969420	9.589814	10.410186	10.030580	10.440766	45
16	9.559558	9.969370	9.590188	10.409812	10.030630	10.440442	44
17	9.559883	9.969321	9.590562	10.409438	10.030679	10.440117	43
18	9.560207	9.969272	9.590935	10.409065	10.030728	10.439793	42
19	9.560531	9.969223	9.591308	10.408692	10.030777	10.439469	41
20	9.560855	9.969173	9.591681	10.408319	10.030827	10.439145	40
21	9.561178	9.969124	9.592054	10.407946	10.030876	10.438822	39
22	9.561501	9.969075	9.592426	10.407574	10.030925	10.438499	38
23	9.561824	9.969025	9.592798	10.407202	10.030975	10.438176	37
24	9.562146	9.968976	9.593171	10.406829	10.031024	10.437854	36
25	9.562468	9.968926	9.593542	10.406458	10.031074	10.437532	35
26	9.562790	9.968877	9.593914	10.406086	10.031123	10.437210	34
27	9.563112	9.968827	9.594285	10.405715	10.031173	10.436888	33
28	9.563433	9.968777	9.594656	10.405344	10.031223	10.436567	32
29	9.563755	9.968728	9.595027	10.404973	10.031272	10.436245	31
30	9.564075	9.968678	9.595398	10.404602	10.031322	10.435925	30
31	9.564396	9.968628	9.595768	10.404232	10.031372	10.435604	29
32	9.564716	9.968578	9.596138	10.403862	10.031422	10.435284	28
33	9.565036	9.968528	9.596508	10.403492	10.031472	10.434964	27
34	9.565356	9.968479	9.596878	10.403122	10.031521	10.434644	26
35	9.565676	9.968429	9.597247	10.402753	10.031571	10.434324	25
36	9.565995	9.968379	9.597616	10.402384	10.031621	10.434005	24
37	9.566314	9.968329	9.597985	10.402015	10.031671	10.433686	23
38	9.566632	9.968278	9.598354	10.401646	10.031722	10.433368	22
39	9.566951	9.968228	9.598722	10.401278	10.031772	10.433049	21
40	9.567269	9.968178	9.599091	10.400909	10.031822	10.432731	20
41	9.567587	9.968128	9.599459	10.400541	10.031872	10.432413	19
42	9.567904	9.968078	9.599827	10.400173	10.031922	10.432096	18
43	9.568222	9.968027	9.600194	10.399806	10.031973	10.431778	17
44	9.568539	9.967977	9.600562	10.399438	10.032023	10.431461	16
45	9.568856	9.967927	9.600929	10.399071	10.032073	10.431144	15
46	9.569172	9.967876	9.601296	10.398704	10.032124	10.430828	14
47	9.569488	9.967826	9.601662	10.398338	10.032174	10.430512	13
48	9.569804	9.967775	9.602029	10.397971	10.032225	10.430196	12
49	9.570120	9.967725	9.602395	10.397605	10.032275	10.429880	11
50	9.570435	9.967674	9.602761	10.397239	10.032326	10.429565	10
51	9.570751	9.967624	9.603127	10.396873	10.032376	10.429249	9
52	9.571066	9.967573	9.603493	10.396507	10.032427	10.428934	8
53	9.571380	9.967522	9.603858	10.396142	10.032478	10.428620	7
54	9.571695	9.967471	9.604223	10.395777	10.032529	10.428305	6
55	9.572009	9.967421	9.604588	10.395412	10.032579	10.427991	5
56	9.572323	9.967370	9.604953	10.395047	10.032630	10.427677	4
57	9.572636	9.967319	9.605317	10.394683	10.032681	10.427364	3
58	9.572950	9.967268	9.605682	10.394318	10.032732	10.427050	2
59	9.573263	9.967217	9.606046	10.393954	10.032783	10.426737	1
60	9.573575	9.967166	9.606410	10.393590	10.032834	10.426425	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

68 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

22 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.573575	9.967166	9.606410	10.393590	10.032834	10.426425	60
1	9.573888	9.967115	9.606773	10.393227	10.032885	10.426112	59
2	9.574200	9.967064	9.607137	10.392863	10.032936	10.425800	58
3	9.574512	9.967013	9.607500	10.392500	10.032987	10.425488	57
4	9.574824	9.966961	9.607863	10.392137	10.033039	10.425176	56
5	9.575136	9.966910	9.608225	10.391775	10.033090	10.424864	55
6	9.575447	9.966859	9.608588	10.391412	10 033141	10.424553	54
7	9.575758	9.966808	9.608950	10.391050	10.033192	10.424242	53
8	9.576069	9.966756	9.609312	10.390688	10.033244	10.423931	52
9	9.576379	9.966705	9.609674	10.390326	10.033295	10.423621	51
10	9.576689	9.966653	9.610036	10.389964	10.033347	10.423311	50
11	9.576999	9.966602	9.610397	10.389603	10.033398	10.423001	49
12	9.577309	9.966550	9.610759	10.389241	10.033450	10.422691	48
13	9.577618	9.966499	9.611120	10.388880	10.033501	10.422382	47
14	9.577927	9.966447	9.611480	10.388520	10.033553	10.422073	46
15	9.578236	9.966395	9.611841	10.388159	10.033605	10.421764	45
16	9.578545	9.966344	9.612201	10.387799	10.033656	10.421455	44
17	9.578853	9.966292	9.612561	10.387439	10.033708	10.421147	43
18	9.579162	9.966240	9.612921	10.387079	10.033760	10.420838	42
19	9.579470	9.966188	9.613281	10.386719	10.033812	10.420530	41
20	9.579777	9.966136	9.613641	10.386359	10.033864	10.420223	40
21	9.580085	9.966085	9.614000	10.386000	10.033915	10.419915	39
22	9.580392	9.966033	9.614359	10.385641	10.033967	10.419608	38
23	9.580699	9.965981	9.614718	10.385282	10.034019	10.419301	37
24	9.581005	9.965929	9.615077	10.384923	10.034071	10.418995	36
25	9.581312	9.965876	9.615435	10.384565	10.034124	10.418688	35
26	9.581618	9.965824	9.615793	10.384207	10.034176	10.418382	34
27	9.581924	9.965772	9.616151	10.383849	10.034228	10.418076	33
28	9.582229	9 965720	9.616509	10.383491	10.034280	10.417771	32
29	9.582535	9 965668	9.616867	10.383133	10.034332	10.417465	31
30	9 582840	9 965615	9.617224	10.382776	10.034385	10.417160	30
31	9.583145	9.965563	9.617582	10.382418	10.034437	10.416855	29
32	9.583449	9.965511	9.617939	10.382061	10.034489	10.416551	28
33	9.583754	9 965458	9.618295	10.381705	10.034542	10.416246	27
34	9.584058	9 965406	9.618652	10.381348	10.034594	10.415942	26
35	9.584361	9.965353	9.619008	10.380992	10.034647	10.415639	25
36	9.584665	9 965301	9.619364	10.380636	10.034699	10.415335	24
37	9.584968	9.965248	9.619721	10.380279	10.034752	10.415032	23
38	9.585272	9.965195	9.620076	10.379924	10.034805	10.414728	22
39	9.585574	9.965143	9.620432	10.379568	10.034857	10.414426	21
40	9.585877	9.965090	9.620787	10.379213	10.034910	10.414123	20
41	9.586179	9.965037	9.621142	10.378858	10.034963	10.413821	19
42	9.586482	9.964984	9.621497	10.378503	10.035016	10.413518	18
43	9 586783	9.964931	9.621852	10.378148	10.035069	10.413217	17
44	9.587085	9.964879	9.622207	10.377793	10.035121	10.412915	16
45	9.587386	9.964826	9.622561	10.377439	10.035174	10.412614	15
46	9.587688	9.964773	9.622915	10.377085	10.035227	10.412312	14
47	9.587989	9.964720	9.623269	10.376731	10.035280	10.412011	13
48	9.588289	9.964666	9.623623	10.376377	10.035334	10.411711	12
49	9.588590	9.964613	9.623976	10.376024	10.035387	10.411410	11
50	9.588890	9.964560	9.624330	10.375670	10.035440	10.411110	10
51	9.589190	9.964507	9.624683	10.375317	10.035493	10.410810	9
52	9.589489	9.964454	9.625036	10.374964	10.035546	10.410511	8
53	9.589789	9.964400	9.625388	10.374612	10.035600	10.410211	7
54	9.590088	9.964347	9.625741	10.374259	10.035653	10.409912	6
55	9.590387	9.964294	9.626093	10.373907	10.035706	10.409613	5
56	9.590686	9.964240	9.626445	10.373555	10.035760	10.409314	4
57	9.590984	9.964187	9.626797	10.373203	10.035813	10.409016	3
58	9.591282	9.964133	9.627149	10.372851	10.035867	10.408718	2
59	9.591580	9.964080	9.627501	10.372499	10.035920	10.408420	1
60	9.591878	9.964026	9.627852	10.372148	10.035974	10.408122	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

67 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

23 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.591878	9.964026	9.627852	10.372148	10.035974	10.408122	60
1	9.592176	9.963972	9.628203	10.371797	10.036028	10.407824	59
2	9 592473	9.963919	9.628554	10.371446	10.036081	10.407527	58
3	9.592770	9.963865	9.628905	10.371095	10.036135	10.407230	57
4	9.593067	9 963811	9.629255	10.370745	10.036189	10.406933	56
5	9.593363	9.963757	9 629606	10.370394	10.036243	10.406637	55
6	9.593659	9.963704	9.629956	10.370044	10.036296	10.406341	54
7	9.593955	9.963650	9.630306	10.369694	10.036350	10.406045	53
8	9.594251	9.963596	9.630656	10.369344	10.036404	10.405749	52
9	9.594547	9.963542	9.631005	10.368995	10.036458	10.405453	51
10	9.594842	9.963488	9.631355	10.368645	10.036512	10.405158	50
11	9.595137	9.963434	9.631704	10.368296	10.036566	10.404863	49
12	9.595432	9.963379	9.632053	10.367947	10.036621	10.404568	48
13	9.595727	9.963325	9.632401	10.367599	10.036675	10.404273	47
14	9.596021	9.963271	9 632750	10.367250	10.036729	10.403979	46
15	9.596315	9.963217	9.633098	10.366902	10.036783	10.403685	45
16	9.596609	9.963163	9.633447	10.366553	10.036837	10.403391	44
17	9.596903	9.963108	9.633795	10.366205	10.036892	10.403097	43
18	9.597196	9.963054	9.634143	10.365857	10.036946	10.402804	42
19	9.597490	9.962999	9.634490	10.365510	10.037001	10.402510	41
20	9.597783	9.962945	9 634838	10.365162	10.037055	10.402217	40
21	9.598075	9.962890	9.635185	10.364815	10.037110	10.401925	39
22	9.598368	9.962836	9.635532	10.364468	10.037164	10.401632	38
23	9.598660	9.962781	9.635879	10.364121	10.037219	10.401340	37
24	9.598952	9.962727	9.636226	10.363774	10.037273	10.401048	36
25	9.599244	9.962672	9.636572	10.363428	10.037328	10.400756	35
26	9.599536	9.962617	9.636919	10.363081	10.037383	10.400464	34
27	9.599827	9.962562	9.637265	10.362735	10.037438	10.400173	33
28	9.600118	9.962508	9.637611	10.362389	10.037492	10.399882	32
29	9.600409	9.962453	9.637956	10.362044	10.037547	10.399591	31
30	9.600700	9.962398	9.638302	10.361698	10.037602	10.399300	30
31	9.600990	9.962343	9.638647	10.361353	10.037657	10.399010	29
32	9.601280	9.962288	9.638992	10.361008	10.037712	10.398720	28
33	9.601570	9.962233	9.639337	10.360663	10.037767	10.398430	27
34	9.601860	9.962178	9.639682	10.360318	10.037822	10.398140	26
35	9.602150	9.962123	9.640027	10.359973	10.037877	10.397850	25
36	9.602439	9.962067	9.640371	10.359629	10.037933	10.397561	24
37	9.602728	9 962012	9.640716	10.359284	10.037988	10.397272	23
38	9.603017	9.961957	9.641060	10.358940	10.038043	10.396983	22
39	9.603305	9.961902	9.641404	10.358596	10.038098	10.396695	21
40	9.603594	9.961846	9.641747	10.358253	10.038154	10.396406	20
41	9.603882	9.961791	9.642091	10.357909	10.038209	10.396118	19
42	9.604170	9 961735	9.642434	10.357566	10.038265	10.395830	18
43	9.604457	9.961680	9.642777	10.357223	10.038320	10.395543	17
44	9.604745	9.961624	9.643120	10.356880	10.038376	10.395255	16
45	9.605032	9.961569	9.643463	10.356537	10.038431	10.394968	15
46	9.605319	9.961513	9.643806	10.356194	10.038487	10.394681	14
47	9.605606	9.961458	9.644148	10.355852	10.038542	10.394394	13
48	9.605892	9.961402	9.644490	10.355510	10.038598	10.394108	12
49	9.606179	9.961346	9.644832	10.355168	10.038654	10.393821	11
50	9 606465	9.961290	9 645174	10.354826	10.038710	10.393535	10
51	9.606751	9.961235	9.645516	10.354484	10.038765	10.393249	9
52	9.607036	9.961179	9.645857	10.354143	10.038821	10.392964	8
53	9.607322	9.961123	9.646199	10.353801	10.038877	10.392678	7
54	9.607607	9.961067	9.646540	10.353460	10.038933	10.392393	6
55	9.607892	9.961011	9.646881	10.353119	10.038989	10.392108	5
56	9.608177	9.960955	9.647222	10.352778	10.039045	10.391823	4
57	9.608461	9.960899	9 647562	10.352438	10.039101	10.391539	3
58	9.608745	9.960843	9.647903	10.352097	10.039157	10.391255	2
59	9.609029	9.960786	9.648243	10.351757	10.039214	10.390971	1
60	9.609313	9.960730	9.648583	10.351417	10.039270	10.390687	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

66 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

24 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.609313	9.960730	9.648583	10.351417	10.039270	10.390687	60
1	9.609597	9.960674	9.648923	10.351077	10.039326	10.390403	59
2	9.609880	9.960618	9.649263	10.350737	10.039382	10.390120	58
3	9.610164	9.960561	9.649602	10.350398	10.039439	10.389836	57
4	9.610447	9.960505	9.649942	10.350058	10.039495	10.389553	56
5	9.610729	9.960448	9.650281	10.349719	10.039552	10.389271	55
6	9.611012	9.960392	9.650620	10.349380	10.039608	10.388988	54
7	9.611294	9.960335	9.650959	10.349041	10.039665	10.388706	53
8	9.611576	9 960279	9.651297	10.348703	10.039721	10.388424	52
9	9.611858	9.960222	9.651636	10.348364	10.039778	10.388142	51
10	9.612140	9.960165	9.651974	10.348026	10.039835	10.387860	50
11	9.612421	9.960109	9.652312	10.347688	10.039891	10.387579	49
12	9.612702	9.960052	9.652650	10.347350	10.039948	10.387298	48
13	9.612983	9.959995	9.652988	10.347012	10.040005	10.387017	47
14	9.613264	9.959938	9.653326	10.346674	10.040062	10.386736	46
15	9.613545	9.959882	9.653663	10.346337	10.040118	10.386455	45
16	9.613825	9.959825	9.654000	10.346000	10.040175	10.386175	44
17	9.614105	9.959768	9.654337	10.345663	10.040232	10.385895	43
18	9.614385	9.959711	9.654674	10.345326	10.040289	10.385615	42
19	9.614665	9.959654	9.655011	10.344989	10.040346	10.385335	41
20	9.614944	9.959596	9.655348	10.344652	10.040404	10.385056	40
21	9.615223	9.959539	9.655684	10.344316	10.040461	10.384777	39
22	9.615502	9.959482	9.656020	10.343980	10.040518	10.384498	38
23	9.615781	9.959425	9.656356	10.343644	10.040575	10.384219	37
24	9.616060	9.959368	9.656692	10.343308	10.040632	10.383940	36
25	9.616338	9.959310	9.657028	10.342972	10.040690	10.383662	35
26	9.616616	9.959253	9.657364	10.342636	10.040747	10.383384	34
27	9.616894	9.959195	9.657699	10.342301	10.040805	10.383106	33
28	9.617172	9.959138	9.658034	10.341966	10.040862	10.382828	32
29	9.617450	9.959080	9.658369	10.341631	10.040919	10.382550	31
30	9.617727	9.959023	9.658704	10.341296	10.040977	10.382273	30
31	9.618004	9.958965	9.659039	10.340961	10.041035	10.381996	29
32	9.618281	9.958908	9.659373	10.340627	10.041092	10.381719	28
33	9.618558	9.958850	9.659708	10.340292	10.041150	10.381442	27
34	9.618834	9.958792	9.660042	10.339958	10.041208	10.381166	26
35	9.619110	9.958734	9.660376	10.339624	10.041266	10.380890	25
36	9.619386	9.958677	9.660710	10.339290	10.041323	10.380614	24
37	9.619662	9.958619	9.661043	10.338957	10.041381	10.380338	23
38	9.619938	9.958561	9.661377	10.338623	10.041439	10.380062	22
39	9.620213	9.958503	9.661710	10.338290	10.041497	10.379787	21
40	9.620488	9.958445	9.662043	10.337957	10.041555	10.379512	20
41	9.620763	9.958387	9.662376	10.337624	10.041613	10.379237	19
42	9.621038	9.958329	9.662709	10.337291	10.041671	10.378962	18
43	9.621313	9.958271	9.663042	10.336958	10.041729	10.378687	17
44	9.621587	9.958213	9 663375	10.336625	10.041787	10.378413	16
45	9.621861	9.958154	9.663707	10.336293	10.041846	10.378139	15
46	9.622135	9.958096	9.664039	10.335961	10.041904	10.377865	14
47	9.622409	9.958038	9.664371	10.335629	10.041962	10.377591	13
48	9.622682	9.957979	9.664703	10.335297	10.042021	10.377318	12
49	9.622956	9.957921	9.665035	10.334965	10.042079	10.377044	11
50	9.623229	9.957863	9.665366	10.334634	10.042137	10.376771	10
51	9.623502	9.957804	9.665697	10.334303	10.042196	10.376498	9
52	9.623774	9.957746	9.666029	10.333971	10.042254	10.376226	8
53	9.624047	9.957687	9.666360	10.333640	10.042313	10.375953	7
54	9.624319	9.957628	9.666691	10.333309	10.042372	10.375681	6
55	9.624591	9.957570	9.667021	10.332979	10.042430	10.375409	5
56	9.624863	9.957511	9.667352	10.332648	10.042489	10.375137	4
57	9.625135	9.957452	9.667682	10.332318	10.042548	10.374865	3
58	9.625406	9.957393	9.668013	10.331987	10.042607	10.374594	2
59	9.625677	9.957335	9.668343	10.331657	10.042665	10.374323	1
60	9.625948	9.957276	9.668672	10.331328	10.042724	10.374052	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

65 Degrees.

TABLE II.

LOGARITHMIC SIGNS, TANGENTS AND SECANTS.

25 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.625948	9.957276	9.668673	10.331327	10.042724	10.374052	60
1	9.626219	9.957217	9.669002	10.330998	10.042783	10.373781	59
2	9.626490	9.957158	9.669332	10.330668	10.042842	10.373510	58
3	9.626760	9.957099	9.669661	10.330339	10.042901	10.373240	57
4	9.627030	9.957040	9.669991	10.330009	10.042960	10.372970	56
5	9.627300	9.956981	9.670320	10.329680	10.043019	10.372700	55
6	9.627570	9.956921	9.670649	10.329351	10.043079	10.372430	54
7	9.627840	9.956862	9.670977	10.329023	10.043138	10.372160	53
8	9.628109	9.956803	9.671306	10.328694	10.043197	10.371891	52
9	9.628378	9.956744	9.671634	10.328366	10.043256	10.371622	51
10	9.628647	9.956684	9.671963	10.328037	10.043316	10.371353	50
11	9.628916	9.956625	9.672291	10.327709	10.043375	10.371084	49
12	9.629185	9.956566	9.672619	10.327381	10.043434	10.370815	48
13	9.629453	9.956506	9.672947	10.327053	10.043494	10.370547	47
14	9.629721	9.956447	9.673274	10.326726	10.043553	10.370279	46
15	9.629989	9.956387	9.673602	10.326398	10.043613	10.370011	45
16	9.630257	9.956327	9.673929	10.326071	10.043673	10.369743	44
17	9.630524	9.956268	9.674257	10.325743	10.043732	10.369476	43
18	9.630792	9.956208	9.674584	10.325416	10.043792	10.369208	42
19	9.631059	9.956148	9.674910	10.325090	10.043852	10.368941	41
20	9.631326	9.956089	9.675237	10.324763	10.043911	10.368674	40
21	9.631593	9.956029	9.675564	10.324436	10.043971	10.368407	39
22	9.631859	9.955969	9.675890	10.324110	10.044031	10.368141	38
23	9.632125	9.955909	9.676217	10.323783	10.044091	10.367875	37
24	9.632392	9.955849	9.676543	10.323457	10.044151	10.367608	36
25	9.632658	9.955789	9.676869	10.323131	10.044211	10.367342	35
26	9.632923	9.955729	9.677194	10.322806	10.044271	10.367077	34
27	9.633189	9.955669	9.677520	10.322480	10.044331	10.366811	33
28	9.633454	9.955609	9.677846	10.322154	10.044391	10.366546	32
29	9.633719	9.955548	9.678171	10.321829	10.044452	10.366281	31
30	9.633984	9.955488	9.678496	10.321504	10.044512	10.366016	30
31	9.634249	9.955428	9.678821	10.321179	10.044572	10.365751	29
32	9.634514	9.955368	9.679146	10.320854	10.044632	10.365486	28
33	9.634778	9.955307	9.679471	10.320529	10.044693	10.365222	27
34	9.635042	9.955247	9.679795	10.320205	10.044753	10.364958	26
35	9.635306	9.955186	9.680120	10.319880	10.044814	10.364694	25
36	9.635570	9.955126	9.680444	10.319556	10.044874	10.364430	24
37	9.635834	9.955065	9.680768	10.319232	10.044935	10.364166	23
38	9.636097	9.955005	9.681092	10.318908	10.044995	10.363903	22
39	9.636360	9.954944	9.681416	10.318584	10.045056	10.363640	21
40	9.636623	9.954883	9.681740	10.318260	10.045117	10.363377	20
41	9.636886	9.954823	9.682063	10.317937	10.045177	10.363114	19
42	9.637148	9.954762	9.682387	10.317613	10.045238	10.362852	18
43	9.637411	9.954701	9.682710	10.317290	10.045299	10.362589	17
44	9.637673	9.954640	9.683033	10.316967	10.045360	10.362327	16
45	9.637935	9.954579	9.683356	10.316644	10.045421	10.362065	15
46	9.638197	9.954518	9.683679	10.316321	10.045482	10.361803	14
47	9.638458	9.954457	9.684001	10.315999	10.045543	10.361542	13
48	9.638720	9.954396	9.684324	10.315676	10.045604	10.361280	12
49	9.638981	9.954335	9.684646	10.315354	10.045665	10.361019	11
50	9.639242	9.954274	9.684968	10.315032	10.045726	10.360758	10
51	9.639503	9.954213	9.685290	10.314710	10.045787	10.360497	9
52	9.639764	9.954152	9.685612	10.314388	10.045848	10.360236	8
53	9.640024	9.954090	9.685934	10.314066	10.045910	10.359976	7
54	9.640284	9.954029	9.686255	10.313745	10.045971	10.359716	6
55	9.640544	9.953968	9.686577	10.313423	10.046032	10.359456	5
56	9.640804	9.953906	9.686898	10.313102	10.046094	10.359196	4
57	9.641064	9.953845	9.687219	10.312781	10.046155	10.358936	3
58	9.641324	9.953783	9.687540	10.312460	10.046217	10.358676	2
59	9.641583	9.953722	9.687861	10.312139	10.046278	10.358417	1
60	9.641842	9.953660	9.688182	10.311818	10.046340	10.358158	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

64 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

26 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.641842	9.953660	9.688182	10.311818	10.046340	10.358158	60
1	9.642101	9.953599	9.688502	10.311498	10.046401	10.357899	59
2	9.642360	9.953537	9.688823	10.311177	10.046463	10.357640	58
3	9.642618	9.953475	9.689143	10.310857	10.046525	10.357382	57
4	9.642877	9.953413	9.689463	10.310537	10.046587	10.357123	56
5	9.643135	9.953352	9.689783	10.310217	10.046648	10.356865	55
6	9.643393	9.953290	9.690103	10.309897	10.046710	10.356607	54
7	9.643650	9.953228	9.690423	10.309577	10.046772	10.356350	53
8	9.643908	9.953166	9.690742	10.309258	10.046834	10.356092	52
9	9.644165	9.953104	9.691062	10.308938	10.046896	10.355835	51
10	9.644423	9.953042	9.691381	10.308619	10.046958	10.355577	50
11	9.644680	9.952980	9.691700	10.308300	10.047020	10.355320	49
12	9.644936	9.952918	9.692019	10.307981	10.047082	10.355064	48
13	9.645193	9.952855	9.692338	10.307662	10.047145	10.354807	47
14	9.645450	9.952793	9.692656	10.307344	10.047207	10.354550	46
15	9.645706	9.952731	9.692975	10.307025	10.047269	10.354294	45
16	9.645962	9.952669	9.693293	10.306707	10.047331	10.354038	44
17	9.646218	9.952606	9.693612	10.306388	10.047394	10.353782	43
18	9.646474	9.952544	9.693930	10.306070	10.047456	10.353526	42
19	9.646729	9.952481	9.694248	10.305752	10.047519	10.353271	41
20	9.646984	9.952419	9.694566	10.305434	10.047581	10.353016	40
21	9.647240	9.952356	9.694883	10.305117	10.047644	10.352760	39
22	9.647494	9.952294	9.695201	10.304799	10.047706	10.352506	38
23	9.647749	9.952231	9.695518	10.304482	10.047769	10.352251	37
24	9.648004	9.952168	9.695836	10.304164	10.047832	10.351996	36
25	9.648258	9.952106	9.696153	10.303847	10.047894	10.351742	35
26	9.648512	9.952043	9.696470	10.303530	10.047957	10.351488	34
27	9.648766	9.951980	9.696787	10.303213	10.048020	10.351234	33
28	9.649020	9.951917	9.697103	10.302897	10.048083	10.350980	32
29	9.649274	9.951854	9.697420	10.302580	10.048146	10.350726	31
30	9.649527	9.951791	9.697736	10.302264	10.048209	10.350473	30
31	9.649781	9.951728	9.698053	10.301947	10.048272	10.350219	29
32	9.650034	9.951665	9.698369	10.301631	10.048335	10.349966	28
33	9.650287	9.951602	9.698685	10.301315	10.048398	10.349713	27
34	9.650539	9.951539	9.699001	10.300999	10.048461	10.349461	26
35	9.650792	9.951476	9.699316	10.300684	10.048524	10.349208	25
36	9.651044	9.951412	9.699632	10.300368	10.048588	10.348956	24
37	9.651297	9.951349	9.699947	10.300053	10.048651	10.348703	23
38	9.651549	9.951286	9.700263	10.299737	10.048714	10.348451	22
39	9.651800	9.951222	9.700578	10.299422	10.048778	10.348200	21
40	9.652052	9.951159	9.700893	10.299107	10.048841	10.347948	20
41	9.652304	9.951096	9.701208	10.298792	10.048904	10.347696	19
42	9.652555	9.951032	9.701523	10.298477	10.048968	10.347445	18
43	9.652806	9.950968	9.701837	10.298163	10.049032	10.347194	17
44	9.653057	9.950905	9.702152	10.297848	10.049095	10.346943	16
45	9.653308	9.950841	9.702466	10.297534	10.049159	10.346692	15
46	9.653558	9.950778	9.702780	10.297220	10.049222	10.346442	14
47	9.653808	9.950714	9.703095	10.296905	10.049286	10.346192	13
48	9.654059	9.950650	9.703409	10.296591	10.049350	10.345941	12
49	9.654309	9.950586	9.703723	10.296277	10.049414	10.345691	11
50	9.654558	9.950522	9.704036	10.295964	10.049478	10.345442	10
51	9.654808	9.950458	9.704350	10.295650	10.049542	10.345192	9
52	9.655058	9.950394	9.704663	10.295337	10.049606	10.344942	8
53	9.655307	9.950330	9.704977	10.295023	10.049670	10.344693	7
54	9.655556	9.950266	9.705290	10.294710	10.049734	10.344444	6
55	9.655805	9.950202	9.705603	10.294397	10.049798	10.344195	5
56	9.656054	9.950138	9.705916	10.294084	10.049862	10.343946	4
57	9.656302	9.950074	9.706228	10.293772	10.049926	10.343698	3
58	9.656551	9.950010	9.706541	10.293459	10.049990	10.343449	2
59	9.656799	9.949945	9.706854	10.293146	10.050055	10.343201	1
60	9.657047	9.949881	9.707166	10.292834	10.050119	10.342953	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

63 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

27 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.657047	9.949881	9.707166	10.292834	10.050119	10.342953	60
1	9.657295	9.949816	9.707478	10.292522	10.050184	10.342705	59
2	9.657542	9.949752	9.707790	10.292210	10.050248	10.342458	58
3	9.657790	9.949688	9.708102	10.291898	10.050312	10.342210	57
4	9.658037	9.949623	9.708414	10.291586	10.050377	10.341963	56
5	9.658284	9.949558	9.708726	10.291274	10.050442	10.341716	55
6	9.658531	9.949494	9.709037	10.290963	10.050506	10.341469	54
7	9.658778	9.949429	9.709349	10.290651	10.050571	10.341222	53
8	9.659025	9.949364	9.709660	10.290340	10.050636	10.340975	52
9	9.659271	9.949300	9.709971	10.290029	10.050700	10.340729	51
10	9.659517	9.949235	9.710282	10.289718	10.050765	10.340483	50
11	9.659763	9.949170	9.710593	10.289407	10.050830	10.340237	49
12	9.660009	9.949105	9.710904	10.289096	10.050895	10.339991	48
13	9.660255	9.949040	9.711215	10.288785	10.050960	10.339745	47
14	9.660501	9.948975	9.711525	10.288475	10.051025	10.339499	46
15	9.660746	9.948910	9.711836	10.288164	10.051090	10.339254	45
16	9.660991	9.948845	9.712146	10.287854	10.051155	10.339009	44
17	9.661236	9.948780	9.712456	10.287544	10.051220	10.338764	43
18	9.661481	9.948715	9.712766	10.287234	10.051285	10.338519	42
19	9.661726	9.948650	9.713076	10.286924	10.051350	10.338274	41
20	9.661970	9.948584	9.713386	10.286614	10.051416	10.338030	40
21	9.662214	9.948519	9.713696	10.286304	10.051481	10.337786	39
22	9.662459	9.948454	9.714005	10.285995	10.051546	10.337541	38
23	9.662703	9.948388	9.714314	10.285686	10.051612	10.337297	37
24	9.662946	9.948323	9.714624	10.285376	10.051677	10.337054	36
25	9.663190	9.948257	9.714933	10.285067	10.051743	10.336810	35
26	9.663433	9.948192	9.715242	10.284758	10.051808	10.336567	34
27	9.663677	9.948126	9.715551	10.284449	10.051874	10.336323	33
28	9.663920	9.948060	9.715860	10.284140	10.051940	10.336080	32
29	9.664163	9.947995	9.716168	10.283832	10.052005	10.335837	31
30	9.664406	9.947929	9.716477	10.283523	10.052071	10.335594	30
31	9.664648	9.947863	9.716785	10.283215	10.052137	10.335352	29
32	9.664891	9.947797	9.717093	10.282907	10.052203	10.335109	28
33	9.665133	9.947731	9.717401	10.282599	10.052269	10.334867	27
34	9.665375	9.947665	9.717709	10.282291	10.052335	10.334625	26
35	9.665617	9.947600	9.718017	10.281983	10.052400	10.334383	25
36	9.665859	9.947533	9.718325	10.281675	10.052467	10.334141	24
37	9.666100	9.947467	9.718633	10.281367	10.052533	10.333900	23
38	9.666342	9.947401	9.718940	10.281060	10.052599	10.333658	22
39	9.666583	9.947335	9.719248	10.280752	10.052665	10.333417	21
40	9.666824	9.947269	9.719555	10.280445	10.052731	10.333176	20
41	9.667065	9.947203	9.719862	10.280138	10.052797	10.332935	19
42	9.667305	9.947136	9 720169	10.279831	10.052864	10.332695	18
43	9.667546	9.947070	9.720476	10.279524	10.052930	10.332454	17
44	9.667786	9.947004	9 720783	10.279217	10.052996	10.332214	16
45	9.668027	9 946937	9.721089	10.278911	10.053063	10.331973	15
46	9.668267	9.946871	9 721396	10.278604	10.053129	10.331733	14
47	9.668506	9.946804	9.721702	10.278298	10.053196	10.331494	13
48	9.668746	9.946738	9.722009	10.277991	10.053262	10.331254	12
49	9.668986	9.946671	9.722315	10.277685	10.053329	10.331014	11
50	9.669225	9.946604	9.722621	10.277379	10.053396	10.330775	10
51	9.669464	9.946538	9.722927	10.277073	10.053462	10.330536	9
52	9.669703	9.946471	9.723232	10.276768	10.053529	10.330297	8
53	9.669942	9.946404	9.723538	10.276462	10.053596	10.330058	7
54	9.670181	9.946337	9.723844	10.276156	10.053663	10.329819	6
55	9.670419	9.946270	9.724149	10.275851	10.053730	10.329581	5
56	9.670658	9.946203	9.724454	10.275546	10.053797	10.329342	4
57	9.670896	9.946136	9.724759	10.275241	10.053864	10.329104	3
58	9.671134	9.946069	9.725065	10.274935	10.053931	10.328866	2
59	9.671372	9.946002	9.725369	10.274631	10.053998	10.328628	1
60	9.671609	9 915935	9.725674	10.274326	10.054065	10.328391	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

62 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

28 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.671609	9.945935	9.725674	10.274326	10.054065	10.328391	60
1	9.671847	9.945868	9.725979	10.274021	10.054132	10.328153	59
2	9.672084	9.945800	9.726284	10.273716	10.054200	10.327916	58
3	9.672321	9.945733	9.726588	10.273412	10.054267	10.327679	57
4	9.672558	9.945666	9.726892	10.273108	10.054334	10.327442	56
5	9.672795	9.945598	9.727197	10.272803	10.054402	10.327205	55
6	9.673032	9.945531	9.727501	10.272499	10.054469	10.326968	54
7	9.673268	9.945464	9.727805	10.272195	10.054536	10.326732	53
8	9.673505	9.945396	9.728109	10.271891	10.054604	10.326495	52
9	9.673741	9.945328	9.728412	10.271588	10.054672	10.326259	51
10	9.673977	9.945261	9.728716	10.271284	10.054739	10.326023	50
11	9.674213	9.945193	9.729020	10.270980	10.054807	10.325787	49
12	9.674448	9.945125	9.729323	10.270677	10.054875	10.325552	48
13	9.674684	9.945058	9.729626	10.270374	10.054942	10.325316	47
14	9.674919	9.944990	9.729929	10.270071	10.055010	10.325081	46
15	9.675155	9.944922	9.730233	10.269767	10.055078	10.324845	45
16	9.675390	9.944854	9.730535	10.269465	10.055146	10.324610	44
17	9.675624	9.944786	9.730838	10.269162	10.055214	10.324376	43
18	9.675859	9.944718	9.731141	10.268859	10.055282	10.324141	42
19	9.676094	9.944650	9.731444	10.268556	10.055350	10.323906	41
20	9.676328	9.944582	9.731746	10.268254	10.055418	10.323672	40
21	9.676562	9.944514	9.732048	10.267952	10.055486	10.323438	39
22	9.676796	9.944446	9.732351	10.267649	10.055554	10.323204	38
23	9.677030	9.944377	9.732653	10.267347	10.055623	10.322970	37
24	9.677264	9.944309	9.732955	10.267045	10.055691	10.322736	36
25	9.677498	9.944241	9.733257	10.266743	10.055759	10.322502	35
26	9.677731	9.944172	9.733558	10.266442	10.055828	10.322269	34
27	9.677964	9.944104	9.733860	10.266140	10.055896	10.322036	33
28	9.678197	9.944036	9.734162	10.265838	10.055964	10.321803	32
29	9.678430	9.943967	9.734463	10.265537	10.056033	10.321570	31
30	9.678663	9.943899	9.734764	10.265236	10.056101	10.321337	30
31	9.678895	9.943830	9.735056	10.264934	10.056170	10.321105	29
32	9.679128	9.943761	9.735367	10.264633	10.056239	10.320872	28
33	9.679360	9.943693	9.735668	10.264332	10.056307	10.320640	27
34	9.679592	9.943624	9.735969	10.264031	10.056376	10.320408	26
35	9.679824	9.943555	9.736269	10.263731	10.056445	10.320176	25
36	9.680056	9.943486	9.736570	10.263430	10.056514	10.319944	24
37	9.680288	9.943417	9.736871	10.263129	10.056583	10.319712	23
38	9.680519	9.943348	9.737171	10.262829	10.056652	10.319481	22
39	9.680750	9.943279	9.737471	10.262529	10.056721	10.319250	21
40	9.680982	9.943210	9.737771	10.262229	10.056790	10.319018	20
41	9.681213	9.943141	9.738071	10.261929	10.056859	10.318787	19
42	9.681443	9.943072	9.738371	10.261629	10.056928	10.318557	18
43	9.681674	9.943003	9.738671	10.261329	10.056997	10.318326	17
44	9.681905	9.942934	9.738971	10.261029	10.057066	10.318095	16
45	9.682135	9.942864	9.739271	10.260729	10.057136	10.317865	15
46	9.682365	9.942795	9.739570	10.260430	10.057205	10.317635	14
47	9.682595	9.942726	9.739870	10.260130	10.057274	10.317405	13
48	9.682825	9.942656	9.740169	10.259831	10.057344	10.317175	12
49	9.683055	9.942587	9.740468	10.259532	10.057413	10.316945	11
50	9.683284	9.942517	9.740767	10.259233	10.057483	10.316716	10
51	9.683514	9.942448	9.741066	10.258934	10.057552	10.316486	9
52	9.683743	9.942378	9.741365	10.258635	10.057622	10.316257	8
53	9.683972	9.942308	9.741664	10.258336	10.057692	10.316028	7
54	9.684201	9.942239	9.741962	10.258038	10.057761	10.315799	6
55	9.684430	9.942169	9.742261	10.257739	10.057831	10.315570	5
56	9.684658	9.942099	9.742559	10.257441	10.057901	10.315342	4
57	9.684887	9.942029	9.742858	10.257142	10.057971	10.315113	3
58	9.685115	9.941959	9.743156	10.256844	10.058041	10.314885	2
59	9.685343	9.941889	9.743454	10.256546	10.058111	10.314657	1
60	9.685571	9.941819	9.743752	10.256248	10.058181	10.314429	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

61 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

29 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.685571	9.941819	9.743752	10.256248	10.058181	10.314429	60
1	9.685799	9.941749	9.744050	10.255950	10.058251	10.314201	59
2	9 686027	9.941679	9.744348	10.255652	10.058321	10.313973	58
3	9.686254	9.941609	9.744645	10.255355	10.058391	10.313746	57
4	9.686482	9.941539	9.744943	10.255057	10.058461	10.313518	56
5	9.686709	9.941469	9.745240	10.254760	10.058531	10.313291	55
6	9.686936	9.941398	9.745538	10.254462	10.058602	10.313064	54
7	9.687163	9.941328	9.745835	10.254165	10.058672	10.312837	53
8	9.687389	9.941258	9.746132	10.253868	10.058742	10.312611	52
9	9.687616	9.941187	9.746429	10.253571	10.058813	10.312384	51
10	9.687843	9.941117	9.746726	10.253274	10.058883	10.312157	50
11	9.688069	9.941046	9.747023	10.252977	10.058954	10.311931	49
12	9.688295	9.940975	9.747319	10.252681	10.059025	10.311705	48
13	9.688521	9.940905	9.747616	10.252384	10.059095	10.311479	47
14	9.688747	9.940834	9.747913	10.252087	10.059166	10.311253	46
15	9.688972	9.940763	9.748209	10.251791	10.059237	10.311028	45
16	9.689198	9.940693	9.748505	10.251495	10.059307	10.310802	44
17	9.689423	9.940622	9.748801	10.251199	10.059378	10.310577	43
18	9.689648	9.940551	9.749097	10.250903	10.059449	10.310352	42
19	9.689873	9.940480	9.749393	10.250607	10.059520	10.310127	41
20	9.690098	9.940409	9.749689	10.250311	10.059591	10.309902	40
21	9.690323	9.940338	9.749985	10.250015	10.059662	10.309677	39
22	9.690548	9.940267	9.750281	10.249719	10.059733	10.309452	38
23	9.690772	9.940196	9.750576	10.249424	10.059804	10.309228	37
24	9.690996	9.940125	9.750872	10.249128	10.059875	10.309004	36
25	9.691220	9.940054	9.751167	10.248833	10.059946	10.308780	35
26	9.691444	9.939982	9.751462	10.248538	10.060018	10.308556	34
27	9.691668	9.939911	9.751757	10.248243	10.060089	10.308332	33
28	9.691892	9.939840	9.752052	10.247948	10.060160	10.308108	32
29	9.692115	9.939768	9.752347	10.247653	10.060232	10.307885	31
30	9 692339	9.939697	9.752642	10.247358	10.060303	10.307661	30
31	9.692562	9.939625	9.752937	10.247063	10.060375	10.307438	29
32	9.692785	9.939554	9.753231	10.246769	10.060446	10.307215	28
33	9.693008	9.939482	9.753526	10.246474	10.060518	10.306992	27
34	9.693231	9.939410	9.753820	10.246180	10.060590	10.306769	26
35	9.693453	9.939339	9.754115	10.245885	10.060661	10.306547	25
36	9.693676	9.939267	9.754409	10.245591	10.060733	10 306324	24
37	9.693898	9.939195	9.754703	10.245297	10.060805	10.306102	23
38	9.694120	9.939123	9.754997	10.245003	10.060877	10.305880	22
39	9.694342	9.939052	9.755291	10.244709	10.060948	10.305658	21
40	9.694564	9.938980	9.755585	10.244415	10.061020	10 305436	20
41	9.694786	9.938908	9.755878	10.244122	10.061092	10.305214	19
42	9.695007	9.938836	9.756172	10.243828	10 061164	10.304993	18
43	9.695229	9.938763	9.756465	10.243535	10.061237	10.304771	17
44	9.695450	9.938691	9.756759	10.243241	10.061309	10.304550	16
45	9.695671	9.938619	9.757052	10.242948	10.061381	10.304329	15
46	9.695892	9.938547	9.757345	10.242655	10.061453	10.304108	14
47	9.696113	9.938475	9.757638	10.242362	10.061525	10.303887	13
48	9.696334	9.938102	9.757931	10.242069	10.061598	10.303666	12
49	9.696554	9.938330	9.758224	10.241776	10.061670	10.303446	11
50	9.696775	9.938258	9.758517	10.241483	10.061742	10.303225	10
51	9.696995	9.938185	9.758810	10.241190	10.061815	10.303005	9
52	9.697215	9.938113	9.759102	10.240898	10.061887	10.302785	8
53	9.697435	9.938040	9.759395	10.240605	10.061960	10.302565	7
54	9.697654	9.937967	9.759687	10.240313	10.062033	10.302346	6
55	9.697874	9.937895	9.759979	10.240021	10.062105	10.302126	5
56	9.698094	9.937822	9.760272	10.239728	10.062178	10.301906	4
57	9.698313	9.937749	9.760564	10.239436	10.062251	10.301687	3
58	9.698532	9.937676	9.760856	10.239144	10.062324	10.301468	2
59	9.698751	9.937604	9.761148	10.238852	10.062396	10.301249	1
60	9.698970	9.937531	9.761439	10.238561	10.062469	10.301030	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

60 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

30 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.698970	9.937531	9.761439	10.238561	10.062469	10.301030	60
1	9.699189	9.937458	9.761731	10.238269	10.062542	10.300811	59
2	9.699407	9.937385	9.762023	10.237977	10.062615	10.300593	58
3	9.699626	9.937312	9.762314	10.237686	10.062688	10.300374	57
4	9.699844	9.937238	9.762606	10.237394	10.062762	10.300156	56
5	9.700062	9.937165	9.762897	10.237103	10.062835	10.299938	55
6	9.700280	9.937092	9.763188	10.236812	10.062908	10.299720	54
7	9.700498	9.937019	9.763479	10.236521	10.062981	10.299502	53
8	9.700716	9.936946	9.763770	10.236230	10.063054	10.299284	52
9	9.700933	9.936872	9.764061	10.235939	10.063128	10.299067	51
10	9.701151	9.936799	9.764352	10.235648	10.063201	10.298849	50
11	9.701368	9.936725	9.764643	10.235357	10.063275	10.298632	49
12	9.701585	9.936652	9.764933	10.235067	10.063348	10.298415	48
13	9.701802	9.936578	9.765224	10.234776	10.063422	10.298198	47
14	9.702019	9.936505	9.765514	10.234486	10.063495	10.297981	46
15	9.702236	9.936431	9.765805	10.234195	10.063569	10.297764	45
16	9.702452	9.936357	9.766095	10.233905	10.063643	10.297548	44
17	9.702669	9.936284	9.766385	10.233615	10.063716	10.297331	43
18	9.702885	9.936210	9.766675	10.233325	10.063790	10.297115	42
19	9.703101	9.936136	9.766965	10.233035	10.063864	10.296899	41
20	9.703317	9.936062	9.767255	10.232745	10.063938	10.296683	40
21	9.703533	9.935988	9.767545	10.232455	10.064012	10.296467	39
22	9.703749	9.935914	9.767834	10.232166	10.064086	10.296251	38
23	9.703964	9.935840	9.768124	10.231876	10.064160	10.296036	37
24	9.704179	9.935766	9.768414	10.231586	10.064234	10.295821	36
25	9.704395	9.935692	9.768703	10.231297	10.064308	10.295605	35
26	9.704610	9.935618	9.768992	10.231008	10.064382	10.295390	34
27	9.704825	9.935543	9.769281	10.230719	10.064457	10.295175	33
28	9.705040	9.935469	9.769570	10.230430	10.064531	10.294960	32
29	9.705254	9.935395	9.769860	10.230140	10.064605	10.294746	31
30	9.705469	9.935320	9.770148	10.229852	10.064680	10.294531	30
31	9.705683	9.935246	9.770437	10.229563	10.064754	10.294317	29
32	9.705898	9.935171	9.770726	10.229274	10.064829	10.294102	28
33	9.706112	9.935097	9.771015	10.228985	10.064903	10.293888	27
34	9.706326	9.935022	9.771303	10.228697	10.064978	10.293674	26
35	9.706539	9.934948	9.771592	10.228408	10.065052	10.293461	25
36	9.706753	9.934873	9.771880	10.228120	10.065127	10.293247	24
37	9.706967	9.934798	9.772168	10.227832	10.065202	10.293033	23
38	9.707180	9.934723	9.772457	10.227543	10.065277	10.292820	22
39	9.707393	9.934649	9.772745	10.227255	10.065351	10.292607	21
40	9.707606	9.934574	9.773033	10.226967	10.065426	10.292394	20
41	9.707819	9.934499	9 773321	10.226679	10.065501	10.292181	19
42	9.708032	9.934424	9.773608	10.226392	10.065576	10.291968	18
43	9.708245	9.934349	9.773896	10.226104	10.065651	10.291755	17
44	9.708458	9.934274	9 774184	10.225816	10.065726	10.291542	16
45	9.708670	9.934199	9.774471	10.225529	10.065801	10.291330	15
46	9.708882	9.934123	9.774759	10.225241	10.065877	10.291118	14
47	9.709094	9.934048	9.775046	10.224954	10.065952	10.290906	13
48	9.709306	9.933973	9.775333	10.224667	10.066027	10.290694	12
49	9.709518	9.933898	9.775621	10.224379	10.066102	10.290482	11
50	9.709730	9.933822	9.775908	10.224092	10.066178	10.290270	10
51	9.709941	9.933747	9.776195	10.223805	10.066253	10.290059	9
52	9.710153	9.933671	9.776482	10.223518	10.066329	10.289847	8
53	9.710364	9.933596	9.776769	10.223231	10.066404	10.289636	7
54	9.710575	9.933520	9.777055	10.222945	10.066480	10.289425	6
55	9.710786	9.933445	9.777342	10.222658	10.066555	10.289214	5
56	9.710997	9.933369	9.777628	10.222372	10.066631	10.289003	4
57	9.711208	9.933293	9.777915	10.222085	10.066707	10.288792	3
58	9.711419	9.933217	9.778201	10.221790	10.066783	10.288581	2
59	9.711629	9.933141	9.778487	10.221513	10.066859	10.288371	1
60	9.711839	9.933066	9.778774	10.221226	10.066934	10.288161	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

59 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

31 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.711839	9.933066	9.778774	10.221226	10.066934	10.288161	60
1	9.712050	9.932990	9.779060	10.220940	10.067010	10.287950	59
2	9 712260	9.932914	9.779346	10.220654	10.067086	10.287740	58
3	9.712469	9.932838	9.779632	10.220368	10.067162	10.287531	57
4	9.712679	9 932762	9.779918	10.220082	10.067238	10.287321	56
5	9.712889	9.932685	9 780203	10.219797	10.067315	10.287111	55
6	9.713098	9.932609	9.780489	10.219511	10.067391	10.286902	54
7	9.713308	9.932533	9.780775	10.219225	10.067467	10.286692	53
8	9.713517	9.932457	9.781060	10.218940	10.067543	10.286483	52
9	9.713726	9.932380	9.781346	10.218654	10.067620	10.286274	51
10	9.713935	9.932304	9.781631	10.218369	10.067696	10.286065	50
11	9.714144	9.932228	9.781916	10.218084	10.067772	10.285856	49
12	9.714352	9.932151	9.782201	10.217799	10.067849	10.285648	48
13	9.714561	9.932075	9.782486	10.217514	10.067925	10.285439	47
14	9.714769	9.931998	9 782771	10.217229	10.068002	10.285231	46
15	9.714978	9.931921	9.783056	10.216944	10.068079	10.285022	45
16	9.715186	9.931845	9 783341	10.216659	10.068155	10.284814	44
17	9.715394	9.931768	9.783626	10.216374	10.068232	10.284606	43
18	9.715602	9.931691	9 783910	10.216090	10.068309	10.284398	42
19	9.715809	9.931614	9.784195	10.215805	10.068386	10.284191	41
20	9.716017	9.931537	9 784479	10.215521	10.068463	10.283983	40
21	9.716224	9.931460	9.784764	10.215236	10.068540	10.283776	39
22	9.716432	9.931383	9.785048	10.214952	10.068617	10.283568	38
23	9.716639	9.931306	9.785332	10.214668	10.068694	10.283361	37
24	9.716846	9.931229	9.785616	10.214384	10.068771	10.283154	36
25	9.717053	9.931152	9.785900	10.214100	10.068848	10.282947	35
26	9.717259	9.931075	9.786184	10.213816	10.068925	10.282741	34
27	9.717466	9.930998	9.786468	10.213532	10.069002	10.282534	33
28	9.717673	9.930921	9.786752	10.213248	10.069079	10.282327	32
29	9.717879	9.930843	9.787036	10.212964	10.069157	10.282121	31
30	9.718085	9.930766	9.787319	10.212681	10.069234	10.281915	30
31	9.718291	9.930688	9.787603	10.212397	10.069312	10.281709	29
32	9.718497	9.930611	9.787886	10.212114	10.069389	10.281503	28
33	9.718703	9.930533	9.788170	10.211830	10.069467	10.281297	27
34	9.718909	9.930456	9.788453	10.211547	10.069544	10.281091	26
35	9.719114	9.930378	9.788736	10.211264	10.069622	10.280886	25
36	9.719320	9.930300	9.789019	10.210981	10.069700	10.280680	24
37	9.719525	9.930223	9.789302	10.210698	10.069777	10.280475	23
38	9.719730	9.930145	9.789585	10.210415	10.069855	10.280270	22
39	9.719935	9.930067	9.789868	10.210132	10.069933	10.280065	21
40	9.720140	9.929989	9.790151	10.209849	10.070011	10.279860	20
41	9.720345	9.929911	9.790433	10.209567	10.070089	10.279655	19
42	9.720549	9 929833	9.790716	10.209284	10.070167	10.279451	18
43	9.720754	9.929755	9.790999	10.209001	10.070245	10.279246	17
44	9.720958	9.929677	9.791281	10.208719	10.070323	10.279042	16
45	9.721162	9.929599	9.791563	10.208437	10.070401	10.278838	15
46	9.721366	9.929521	9.791846	10.208154	10.070479	10.278634	14
47	9.721570	9.929442	9.792128	10.207872	10.070558	10.278430	13
48	9.721774	9.929364	9.792410	10.207590	10.070636	10.278226	12
49	9.721978	9.929286	9.792692	10.207308	10.070714	10.278022	11
50	9 722181	9.929207	9 792974	10.207026	10.070793	10.277819	10
51	9.722385	9.929129	9.793256	10.206744	10.070871	10.277615	9
52	9.722588	9.929050	9.793538	10.206462	10.070950	10.277412	8
53	9.722791	9.928972	9.793819	10.206181	10.071028	10.277209	7
54	9.722994	9.928893	9.794101	10.205899	10.071107	10.277006	6
55	9.723197	9.928815	9.794383	10.205617	10.071185	10.276803	5
56	9.723400	9.928736	9.794664	10.205336	10.071264	10.276600	4
57	9.723603	9.928657	9.794945	10.205055	10.071343	10.276397	3
58	9.723805	9.928578	9.795227	10.204773	10.071422	10.276195	2
59	9.724007	9.928499	9.795508	10.204492	10.071501	10.275993	1
60	9.724210	9.928420	9.795789	10.204211	10.071580	10.275790	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

58 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

32 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.724210	9.928420	9.795789	10.204211	10.071580	10.275790	60
1	9.724412	9.928342	9.796070	10.203930	10.071658	10.275588	59
2	9.724614	9.928263	9.796351	10.203649	10.071737	10.275386	58
3	9.724816	9.928183	9.796632	10.203368	10.071817	10.275184	57
4	9.725017	9.928104	9.796913	10.203087	10.071896	10.274983	56
5	9.725219	9.928025	9.797194	10.202806	10.071975	10.274781	55
6	9.725420	9.927946	9.797475	10.202525	10.072054	10.274580	54
7	9.725622	9.927867	9.797755	10.202245	10.072133	10.274378	53
8	9.725823	9 927787	9.798036	10.201964	10.072213	10.274177	52
9	9.726024	9.927708	9.798316	10.201684	10.072292	10.273976	51
10	9.726225	9.927629	9.798596	10.201404	10.072371	10.273775	50
11	9.726426	9 927549	9.798877	10.201123	10.072451	10.273574	49
12	9.726626	9.927470	9.799157	10.200843	10.072530	10.273374	48
13	9.726827	9.927390	9.799437	10.200563	10.072610	10.273173	47
14	9.727027	9.927310	9.799717	10.200283	10.072690	10.272973	46
15	9.727228	9.927231	9.799997	10.200003	10.072769	10.272772	45
16	9.727428	9.927151	9.800277	10.199723	10.072849	10.272572	44
17	9.727628	9.927071	9.800557	10.199443	10.072929	10.272372	43
18	9.727828	9.926991	9.800836	10.199164	10.073009	10.272172	42
19	9.728027	9.926911	9.801116	10.198884	10.073089	10.271973	41
20	9.728227	9.926831	9.801396	10 198604	10.073169	10.271773	40
21	9.728427	9.926751	9 801675	10.198325	10.073249	10.271573	39
22	9.728626	9.926671	9.801955	10.198045	10.073329	10.271374	38
23	9.728825	9.926591	9.802234	10.197766	10.073409	10.271175	37
24	9.729024	9.926511	9.802513	10.197487	10.073489	10.270976	36
25	9.729223	9.926431	9.802792	10.197208	10.073569	10.270777	35
26	9.729422	9.926351	9.803072	10.196928	10.073649	10.270578	34
27	9.729621	9.926270	9.803351	10.196649	10.073730	10.270379	33
28	9 729820	9.926190	9.803630	10.196370	10.073810	10.270180	32
29	9.730018	9.926110	9.803908	10.196092	10.073890	10.269982	31
30	9.730217	9.926029	9.804187	10.195813	10.073971	10.269783	30
31	9 730415	9.925949	9.804466	10.195534	10.074051	10.269585	29
32	9.730613	9.925868	9.804745	10.195255	10.074132	10.269387	28
33	9.730811	9.925788	9.805023	10.194977	10.074212	10.269189	27
34	9.731009	9.925707	9.805302	10.194698	10.074293	10.268991	26
35	9.731206	9.925626	9.805580	10.194420	10.074374	10.268794	25
36	9.731404	9.925545	9.805859	10.194141	10.074455	10.268596	24
37	9.731602	9.925465	9.806137	10.193863	10.074535	10.268398	23
38	9.731799	9 925384	9.806415	10.193585	10.074616	10.268201	22
39	9.731996	9.925303	9.806693	10.193307	10.074697	10.268004	21
40	9.732193	9.925222	9.806971	10.193029	10.074778	10.267807	20
41	9 732390	9.925141	9.807249	10.192751	10.074859	10.267610	19
42	9.732587	9.925060	9.807527	10.192473	10.074940	10.267413	18
43	9.732784	9.924979	9.807805	10.192195	10.075021	10.267216	17
44	9.732980	9.924897	9.808083	10.191917	10.075103	10.267020	16
45	9.733177	9.924816	9.808361	10.191639	10.075184	10.266823	15
46	9.733373	9.924735	9.808638	10.191362	10.075265	10.266627	14
47	9.733569	9.924654	9.808916	10.191084	10.075346	10.266431	13
48	9.733765	9.924572	9.809193	10.190807	10.075428	10.266235	12
49	9.733961	9.924491	9.809471	10.190529	10.075509	10.266039	11
50	9.734157	9.924409	9.809748	10.190252	10.075591	10.265843	10
51	9.734353	9.924328	9.810025	10.189975	10.075672	10.265647	9
52	9.734549	9.924246	9.810302	10.189698	10.075754	10.265451	8
53	9.734744	9.924164	9.810580	10.189420	10.075836	10.265256	7
54	9.734939	9.924083	9.810857	10.189143	10.075917	10.265061	6
55	9.735135	9.924001	9.811134	10.188866	10.075999	10.264865	5
56	9.735330	9.923919	9.811410	10.188590	10.076081	10.264670	4
57	9.735525	9.923837	9.811687	10.188313	10.076163	10.264475	3
58	9.735719	9.923755	9.811964	10.188036	10.076245	10.264281	2
59	9.735914	9.923673	9.812241	10.187759	10.076327	10.264086	1
60	9.736109	9.923591	9.812517	10.187483	10.076409	10.263891	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

57 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

33 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.736109	9.923591	9.812517	10.187483	10.076409	10.263891	60
1	9.736303	9.923509	9.812794	10.187206	10.076491	10.263697	59
2	9.736498	9.923427	9.813070	10.186930	10.076573	10.263502	58
3	9.736692	9.923345	9.813347	10.186653	10.076655	10.263308	57
4	9.736886	9.923263	9.813623	10.186377	10.076737	10.263114	56
5	9.737080	9.923181	9.813899	10.186101	10.076819	10.262920	55
6	9.737274	9.923098	9.814175	10.185825	10.076902	10.262726	54
7	9.737467	9.923016	9.814452	10.185548	10.076984	10.262533	53
8	9.737661	9.922933	9.814728	10.185272	10.077067	10.262339	52
9	9.737855	9.922851	9.815004	10.184996	10.077149	10.262145	51
10	9.738048	9.922768	9.815279	10.184721	10.077232	10.261952	50
11	9.738241	9.922686	9.815555	10.184445	10.077314	10.261759	49
12	9.738434	9.922603	9.815831	10.184169	10.077397	10.261566	48
13	9.738627	9.922520	9.816107	10.183893	10.077480	10.261373	47
14	9.738820	9.922438	9.816382	10.183618	10.077562	10.261180	46
15	9.739013	9.922355	9.816658	10.183342	10.077645	10.260987	45
16	9.739206	9.922272	9.816933	10.183067	10.077728	10.260794	44
17	9.739398	9.922189	9.817209	10.182791	10.077811	10.260602	43
18	9.739590	9.922106	9.817484	10.182516	10.077894	10.260410	42
19	9.739783	9.922023	9.817759	10.182241	10.077977	10.260217	41
20	9.739975	9.921940	9.818035	10.181965	10.078060	10.260025	40
21	9.740167	9.921857	9.818310	10.181690	10.078143	10.259833	39
22	9.740359	9.921774	9.818585	10.181415	10.078226	10.259641	38
23	9.740550	9.921691	9.818860	10.181140	10.078309	10.259450	37
24	9.740742	9.921607	9.819135	10.180865	10.078393	10.259258	36
25	9.740934	9.921524	9.819410	10.180590	10.078476	10.259066	35
26	9.741125	9.921441	9.819684	10.180316	10.078559	10.258875	34
27	9.741316	9.921357	9.819959	10.180041	10.078643	10.258684	33
28	9.741508	9.921274	9.820234	10.179766	10.078726	10.258492	32
29	9.741699	9.921190	9.820508	10.179492	10.078810	10.258301	31
30	9.741889	9.921107	9.820783	10.179217	10.078893	10.258111	30
31	9.742080	9.921023	9.821057	10.178943	10.078977	10.257920	29
32	9.742271	9.920939	9.821332	10.178668	10.079061	10.257729	28
33	9.742462	9.920856	9.821606	10.178394	10.079144	10.257538	27
34	9.742652	9.920772	9.821880	10.178120	10.079228	10.257348	26
35	9.742842	9.920688	9.822154	10.177846	10.079312	10.257158	25
36	9.743033	9.920604	9.822429	10.177571	10.079396	10.256967	24
37	9.743223	9.920520	9.822703	10.177297	10.079480	10.256777	23
38	9.743413	9.920436	9.822977	10.177023	10.079564	10.256587	22
39	9.743602	9.920352	9.823250	10.176750	10.079648	10.256398	21
40	9.743792	9.920268	9.823524	10.176476	10.079732	10.256208	20
41	9.743982	9.920184	9.823798	10.176202	10.079816	10.256018	19
42	9.744171	9.920099	9.824072	10.175928	10.079901	10.255829	18
43	9.744361	9.920015	9.824345	10.175655	10.079985	10.255639	17
44	9.744550	9.919931	9.824619	10.175381	10.080069	10.255450	16
45	9.744739	9.919846	9.824893	10.175107	10.080154	10.255261	15
46	9.744928	9.919762	9.825166	10.174834	10.080238	10.255072	14
47	9.745117	9.919677	9.825439	10.174561	10.080323	10.254883	13
48	9.745306	9.919593	9.825713	10.174287	10.080407	10.254694	12
49	9.745494	9.919508	9.825986	10.174014	10.080492	10.254506	11
50	9.745683	9.919424	9.826259	10.173741	10.080576	10.254317	10
51	9.745871	9.919339	9.826532	10.173468	10.080661	10.254129	9
52	9.746060	9.919254	9.826805	10.173195	10.080746	10.253940	8
53	9.746248	9.919169	9.827078	10.172922	10.080831	10.253752	7
54	9.746436	9.919085	9.827351	10.172649	10.080915	10.253564	6
55	9.746624	9.919000	9.827624	10.172376	10.081000	10.253376	5
56	9.746812	9.918915	9.827897	10.172103	10.081085	10.253188	4
57	9.746999	9.918830	9.828170	10.171830	10.081170	10.253001	3
58	9.747187	9.918745	9.828442	10.171558	10.081255	10.252813	2
59	9.747374	9.918659	9.828715	10.171285	10.081341	10.252626	1
60	9.747562	9.918574	9.828987	10.171013	10.081426	10.252438	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

56 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

34 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.747562	9.918574	9.828987	10.171013	10.081426	10.252438	60
1	9.747749	9.918489	9.829260	10.170740	10.081511	10.252251	59
2	9.747936	9.918404	9.829532	10.170468	10.081596	10.252064	58
3	9.748123	9.918318	9.829805	10.170195	10.081682	10.251877	57
4	9.748310	9.918233	9.830077	10.169923	10.081767	10.251690	56
5	9.748497	9.918147	9.830349	10.169651	10.081853	10.251503	55
6	9.748683	9.918062	9.830621	10.169379	10.081938	10.251317	54
7	9.748870	9.917976	9.830893	10.169107	10.082024	10.251130	53
8	9.749056	9.917891	9.831165	10.168835	10.082109	10.250944	52
9	9.749243	9.917805	9.831437	10.168563	10.082195	10.250757	51
10	9.749429	9.917719	9.831709	10.168291	10.082281	10.250571	50
11	9.749615	9.917634	9.831981	10.168019	10.082366	10.250385	49
12	9.749801	9.917548	9.832253	10.167747	10.082452	10.250199	48
13	9.749987	9.917462	9.832525	10.167475	10.082538	10.250013	47
14	9.750172	9.917376	9.832796	10.167204	10.082624	10.249828	46
15	9.750358	9.917290	9.833068	10.166932	10.082710	10.249642	45
16	9.750543	9.917204	9.833339	10.166661	10.082796	10.249457	44
17	9.750729	9.917118	9.833611	10.166389	10.082882	10.249271	43
18	9.750914	9.917032	9.833882	10.166118	10.082968	10.249086	42
19	9.751099	9.916946	9.834154	10.165846	10.083054	10.248901	41
20	9.751284	9.916859	9.834425	10.165575	10.083141	10.248716	40
21	9.751469	9.916773	9.834696	10.165304	10.083227	10.248531	39
22	9.751654	9.916687	9.834967	10.165033	10.083313	10.248346	38
23	9.751839	9.916600	9.835238	10.164762	10.083400	10.248161	37
24	9.752023	9.916514	9.835509	10.164491	10.083486	10.247977	36
25	9.752208	9.916427	9.835780	10.164220	10.083573	10.247792	35
26	9.752392	9.916341	9.836051	10.163949	10.083659	10.247608	34
27	9.752576	9.916254	9.836322	10.163678	10.083746	10.247424	33
28	9.752760	9.916167	9.836593	10.163407	10.083833	10.247240	32
29	9.752944	9.916081	9.836864	10.163136	10.083919	10.247056	31
30	9.753128	9.915994	9.837134	10.162866	10.084006	10.246872	30
31	9.753312	9.915907	9.837405	10.162595	10.084093	10.246688	29
32	9.753495	9.915820	9.837675	10.162325	10.084180	10.246505	28
33	9.753679	9.915733	9.837946	10.162054	10.084267	10.246321	27
34	9.753862	9.915646	9.838216	10.161784	10.084354	10.246138	26
35	9.754046	9.915559	9.838487	10.161513	10.084441	10.245954	25
36	9.754229	9.915472	9.838757	10.161243	10.084528	10.245771	24
37	9.754412	9.915385	9.839027	10.160973	10.084615	10.245588	23
38	9.754595	9.915297	9.839297	10.160703	10.084703	10.245405	22
39	9.754778	9.915210	9.839568	10.160432	10.084790	10.245222	21
40	9.754960	9.915123	9.839838	10.160162	10.084877	10.245040	20
41	9.755143	9.915035	9.840108	10.159892	10.084965	10.244857	19
42	9.755326	9.914948	9.840378	10.159622	10.085052	10.244674	18
43	9.755508	9.914860	9.840647	10.159353	10.085140	10.244492	17
44	9.755690	9.914773	9.840917	10.159083	10.085227	10.244310	16
45	9.755872	9.914685	9.841187	10.158813	10.085315	10.244128	15
46	9.756054	9.914598	9.841457	10.158543	10.085402	10.243946	14
47	9.756236	9.914510	9.841726	10.158274	10.085490	10.243764	13
48	9.756418	9.914422	9.841996	10.158004	10.085578	10.243582	12
49	9.756600	9.914334	9.842266	10.157734	10.085666	10.243400	11
50	9.756782	9.914246	9.842535	10.157465	10.085754	10.243218	10
51	9.756963	9.914158	9.842805	10.157195	10.085842	10.243037	9
52	9.757144	9.914070	9.843074	10.156926	10.085930	10.242856	8
53	9.757326	9.913982	9.843343	10.156657	10.086018	10.242674	7
54	9.757507	9.913894	9.843612	10.156388	10.086106	10.242493	6
55	9.757688	9.913806	9.843882	10.156118	10.086194	10.242312	5
56	9.757869	9.913718	9.844151	10.155849	10.086282	10.242131	4
57	9.758050	9.913630	9.844420	10.155580	10.086370	10.241950	3
58	9.758230	9.913541	9.844689	10.155311	10.086459	10.241770	2
59	9.758411	9.913453	9.844958	10.155042	10.086547	10.241589	1
60	9.758591	9.913365	9.845227	10.154773	10.086635	10.241409	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

55 Degrees.

TABLE II.

LOGARITHMIC SIGNS, TANGENTS AND SECANTS.

35 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.758591	9.913365	9.845227	10.154773	10.086635	10.241409	60
1	9.758772	9 913276	9.845496	10.154504	10.086724	10.241228	59
2	9.758952	9.913187	9.845764	10.154236	10.086813	10.241048	58
3	9.759132	9.913099	9.846033	10.153967	10.086901	10.240868	57
4	9 759312	9.913010	9.846302	10.153698	10.086990	10.240688	56
5	9.759492	9.912922	9.846570	10.153430	10.087078	10.240508	55
6	9.759672	9.912833	9.846839	10.153161	10.087167	10.240328	54
7	9.759852	9.912744	9.847107	10.152893	10.087256	10.240148	53
8	9.760031	9.912655	9.847376	10.152624	10.087345	10.239969	52
9	9.760211	9.912566	9.847644	10.152356	10.087434	10.239789	51
10	9.760390	9.912477	9.847913	10.152087	10.087523	10.239610	50
11	9.760569	9.912388	9.848181	10.151819	10.087612	10.239431	49
12	9.760748	9.912299	9.848449	10.151551	10.087701	10.239252	48
13	9.760927	9.912210	9.848717	10.151283	10.087790	10.239073	47
14	9.761106	9.912121	9.848986	10.151014	10.087879	10.238894	46
15	9.761285	9.912031	9.849254	10.150746	10.087969	10.238715	45
16	9.761464	9.911942	9.849522	10.150478	10.088058	10.238536	44
17	9.761642	9 911853	9.849790	10.150210	10.088147	10.238358	43
18	9.761821	9.911763	9.850058	10.149942	10.088237	10.238179	42
19	9.761999	9.911674	9.850325	10.149675	10.088326	10.238001	41
20	9.762177	9 911584	9.850593	10.149407	10.088416	10.237823	40
21	9.762356	9.911495	9.850861	10.149139	10.088505	10.237644	39
22	9.762534	9.911405	9.851129	10.148871	10.088595	10.237466	38
23	9.762712	9 911315	9.851396	10.148604	10.088685	10.237288	37
24	9.762889	9.911226	9.851664	10.148336	10.088774	10.237111	36
25	9.763067	9.911136	9 851931	10.148069	10.088864	10.236933	35
26	9 763245	9.911046	9 852199	10.147801	10.088954	10.236755	34
27	9 763422	9.910956	9 852466	10.147534	10.089044	10.236578	33
28	9.763600	9.910866	9.852733	10.147267	10.089134	10.236400	32
29	9.763777	9.910776	9.853001	10.146999	10.089224	10.236223	31
30	9.763954	9.910686	9.853268	10.146732	10.089314	10.236046	30
31	9.764131	9.910596	9.853535	10.146465	10.089404	10.235869	29
32	9.764308	9.910506	9.853802	10.146198	10.089494	10.235692	28
33	9.764485	9.910415	9.854069	10.145931	10.089585	10.235515	27
34	9.764662	9.910325	9.854336	10.145664	10.089675	10.235338	26
35	9.764838	9.910235	9.854603	10.145397	10.089765	10.235162	25
36	9.765015	9.910144	9.854870	10.145130	10.089856	10.234985	24
37	9.765191	9.910054	9.855137	10.144863	10.089946	10.234809	23
38	9.765367	9.909963	9.855404	10.144596	10.090037	10.234633	22
39	9.765544	9.909873	9.855671	10.144329	10.090127	10.234456	21
40	9.765720	9.909782	9.855938	10.144062	10.090218	10.234280	20
41	9.765896	9.909691	9.856204	10.143796	10.090309	10.234104	19
42	9.766072	9.909601	9.856471	10.143529	10.090399	10.233928	18
43	9.766247	9.909510	9.856737	10.143263	10.090490	10.233753	17
44	9.766423	9.909419	9.857004	10.142996	10.090581	10.233577	16
45	9.766598	9.909328	9.857270	10.142730	10.090672	10.233402	15
46	9.766774	9.909237	9.857537	10.142463	10.090763	10.233226	14
47	9.766949	9.909146	9.857803	10.142197	10.090854	10.233051	13
48	9.767124	9.909055	9.858069	10.141931	10.090945	10.232876	12
49	9.767300	9.908964	9.858336	10.141664	10.091036	10.232700	11
50	9.767475	9.908873	9.858602	10.141398	10.091127	10.232525	10
51	9.767649	9.908781	9.858868	10.141132	10.091219	10.232351	9
52	9.767824	9.908690	9.859134	10.140866	10.091310	10.232176	8
53	9.767999	9.908599	9.859400	10.140600	10.091401	10.232001	7
54	9.768173	9.908507	9.859666	10.140334	10.091493	10.231827	6
55	9.768348	9.908416	9.859932	10.140068	10.091584	10.231652	5
56	9.768522	9.908324	9.860198	10.139802	10.091676	10.231478	4
57	9.768697	9.908233	9.860464	10.139536	10.091767	10.231303	3
58	9.768871	9.908141	9.860730	10.139270	10.091859	10.231129	2
59	9.769045	9.908049	9.860995	10.139005	10.091951	10.230955	1
60	9.769219	9.907958	9.861261	10.138739	10.092042	10.230781	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

54 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

36 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.769219	9.907958	9.861261	10.138739	10 092042	10.230781	60
1	9.769393	9.907866	9.861527	10.138473	10.092134	10.230607	59
2	9.769566	9.907774	9.861792	10.138208	10.092226	10.230434	58
3	9.769740	9.907682	9.862058	10.137942	10.092318	10.230260	57
4	9.769913	9.907590	9.862323	10.137677	10.092410	10.230087	56
5	9.770087	9.907498	9.862589	10.137411	10.092502	10.229913	55
6	9.770260	9.907406	9.862854	10.137146	10.092594	10.229740	54
7	9.770433	9.907314	9.863119	10.136881	10.092686	10.229567	53
8	9.770606	9.907222	9.863385	10.136615	10.092778	10.229394	52
9	9.770779	9.907129	9.863650	10.136350	10.092871	10.229221	51
10	9.770952	9.907037	9.863915	10.136085	10.092963	10.229048	50
11	9.771125	9.906945	9.864180	10.135820	10.093055	10.228875	49
12	9.771298	9.906852	9.864445	10.135555	10.093148	10.228702	48
13	9.771470	9.906760	9.864710	10.135290	10.093240	10.228530	47
14	9.771643	9.906667	9.864975	10.135025	10.093333	10.228357	46
15	9.771815	9.906575	9.865240	10.134760	10.093425	10.228185	45
16	9.771987	9.906482	9.865505	10.134495	10.093518	10.228013	44
17	9.772159	9.906389	9.865770	10.134230	10.093611	10.227841	43
18	9.772331	9.906296	9.866035	10.133965	10.093704	10.227669	42
19	9.772503	9.906204	9.866300	10.133700	10.093796	10.227497	41
20	9.772675	9.906111	9.866564	10.133436	10.093889	10.227325	40
21	9.772847	9.906018	9.866829	10.133171	10.093982	10.227153	39
22	9.773018	9.905925	9.867094	10.132906	10.094075	10.226982	38
23	9.773190	9.905832	9.867358	10.132642	10.094168	10.226810	37
24	9.773361	9.905739	9 867623	10.132377	10.094261	10.226639	36
25	9.773533	9.905645	9.867887	10.132113	10.094355	10.226467	35
26	9.773704	9.905552	9.868152	10.131848	10.094448	10.226296	34
27	9.773875	9.905459	9.868416	10.131584	10.094541	10.226125	33
28	9.774046	9.905366	9.868680	10.131320	10.094634	10.225954	32
29	9.774217	9.905272	9.868945	10.131055	10.094728	10.225783	31
30	9.774388	9.905179	9.869209	10.130791	10.094821	10.225612	30
31	9.774558	9.905085	9.869473	10.130527	10.094915	10.225442	29
32	9.774729	9.904992	9.869737	10.130263	10.095008	10.225271	28
33	9.774899	9.904898	9.870001	10.129999	10.095102	10.225101	27
34	9.775070	9.904804	9.870265	10.129735	10.095196	10.224930	26
35	9.775240	9.904711	9.870529	10.129471	10.095289	10.224760	25
36	9.775410	9.904617	9.870793	10.129207	10.095383	10.224590	24
37	9.775580	9.904523	9.871057	10.128943	10.095477	10.224420	23
38	9.775750	9.904429	9.871321	10.128679	10.095571	10.224250	22
39	9.775920	9.904335	9.871585	10.128415	10.095665	10.224080	21
40	9.776090	9.904241	9.871849	10.128151	10.095759	10.223910	20
41	9.776259	9.904147	9.872112	10.127888	10.095853	10.223741	19
42	9.776429	9.904053	9.872376	10.127624	10.095947	10.223571	18
43	9.776598	9.903959	9 872640	10.127360	10.096041	10.223402	17
44	9.776768	9.903864	9 872903	10.127097	10.096136	10.223232	16
45	9.776937	9.903770	9.873167	10.126833	10.096230	10.223063	15
46	9.777106	9.903676	9.873430	10.126570	10.096324	10.222894	14
47	9.777275	9.903581	9.873694	10.126306	10.096419	10.222725	13
48	9.777444	9.903487	9.873957	10.126043	10.096513	10.222556	12
49	9.777613	9.903392	9.874220	10.125780	10.096608	10.222387	11
50	9.777781	9.903298	9.874484	10.125516	10.096702	10.222219	10
51	9.777950	9.903203	9.874747	10.125253	10.096797	10.222050	9
52	9.778119	9.903108	9.875010	10.124990	10.096892	10.221881	8
53	9.778287	9.903014	9.875273	10.124727	10.096986	10.221713	7
54	9.778455	9.902919	9.875536	10.124464	10.097081	10.221545	6
55	9.778624	9.902824	9.875800	10.124200	10.097176	10.221376	5
56	9.778792	9.902729	9.876063	10.123937	10.097271	10.221208	4
57	9.778960	9.902634	9.876326	10.123674	10.097366	10.221040	3
58	9.779128	9.902539	9.876589	10.123411	10.097461	10.220872	2
59	9.779295	9.902444	9.876851	10.123149	10.097556	10.220705	1
60	9.779463	9.902349	9.877114	10.122886	10.097651	10.220537	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

53 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

37 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.779463	9.902349	9.877114	10 122886	10.097651	10.220537	60
1	9.779631	9.902253	9.877377	10.122623	10.097747	10.220369	59
2	9.779798	9.902158	9.877640	10.122360	10.097842	10.220202	58
3	9.779966	9.902063	9.877903	10.122097	10.097937	10.220034	57
4	9.780133	9.901967	9.878165	10.121835	10.098033	10.219867	56
5	9.780300	9.901872	9.878428	10.121572	10.098128	10.219700	55
6	9.780467	9.901776	9.878691	10.121309	10.098224	10.219533	54
7	9.780634	9.901681	9.878953	10.121047	10.098319	10.219366	53
8	9.780801	9.901585	9.879216	10.120784	10.098415	10.219199	52
9	9.780968	9.901490	9.879478	10.120522	10.098510	10.219032	51
10	9 781134	9.901394	9 879741	10.120259	10.098606	10.218866	50
11	9.781301	9 901298	9.880003	10.119997	10.098702	10.218699	49
12	9 781468	9.901202	9.880265	10.119735	10.098798	10.218532	48
13	9.781634	9.901106	9.880528	10.119472	10.098894	10.218366	47
14	9.781800	9 901010	9.880790	10.119210	10.098990	10,218200	46
15	9 781966	9.900914	9.881052	10.118948	10.099086	10.218034	45
16	9.782132	9.900818	9.881314	10.118686	10.099182	10.217868	44
17	9.782298	9 900722	9.881576	10.118424	10.099278	10.217702	43
18	9.782464	9.900626	9.881839	10.118161	10.099374	10.217536	42
19	9.782630	9 900529	9.882101	10.117899	10.099471	10.217370	41
20	9.782796	9.900433	9.882363	10.117637	10.099567	10.217204	40
21	9.782961	9.900337	9.882625	10.117375	10.099663	10.217039	39
22	9.783127	9.900240	9.882887	10.117113	10.099760	10.216873	38
23	9.783292	9.900144	9.883148	10.116852	10.099856	10.216708	37
24	9 783458	9.900047	9.883410	10.116590	10.099953	10.216542	36
25	9.783623	9 899951	9.883672	10.116328	10.100049	10.216377	35
26	9.783788	9.899854	9.883934	10.116066	10.100146	10.216212	34
27	9.783953	9.899757	9.884196	10.115804	10.100243	10.216047	33
28	9.784118	9.899660	9.884457	10.115543	10.100340	10.215882	32
29	9.784282	9.899564	9.884719	10.115281	10.100436	10.215718	31
30	9.784447	9.899467	9.884980	10.115020	10.100533	10.215553	30
31	9 784612	9.899370	9.885242	10.114758	10.100630	10.215388	29
32	9.784776	9.899273	9 855503	10.114497	10.100727	10.215224	28
33	9.784941	9.899176	9.885765	10.114235	10.100824	10.215059	27
34	9.785105	9.899078	9.886026	10.113974	10.100922	10.214895	26
35	9 785269	9.898981	9.886288	10.113712	10.101019	10.214731	25
36	9 785433	9.898884	9.886549	10.113451	10.101116	10.214567	24
37	9.785597	9 898787	9.886810	10.113190	10.101213	10.214403	23
38	9.785761	9.898689	9.887072	10.112928	10.101311	10.214239	22
39	9.785925	9.898592	9.887333	10.112667	10.101408	10.214075	21
40	9.786089	9.898494	9.887594	10.112406	10.101506	10.213911	20
41	9.786252	9.898397	9.887855	10.112145	10.101603	10.213748	19
42	9.786416	9.898299	9.888116	10.111884	10.101701	10.213584	18
43	9.786579	9.898202	9.888377	10.111623	10.101798	10.213421	17
44	9.786742	9.898104	9 888639	10.111361	10.101896	10.213258	16
45	9.786906	9.898006	9.888900	10.111100	10.101994	10.213094	15
46	9.787069	9.897908	9.889160	10.110840	10.102092	10.212931	14
47	9.787232	9.897810	9.889421	10.110579	10.102190	10.212768	13
48	9.787395	9.897712	9.889682	10.110318	10.102288	10.212605	12
49	9.787557	9.897614	9.889943	10.110057	10.102386	10.212443	11
50	9.787720	9.897516	9.890204	10.109796	10.102484	10.212280	10
51	9.787883	9.897418	9.890465	10.109535	10.102582	10.212117	9
52	9.788045	9.897320	9.890725	10.109275	10.102680	10.211955	8
53	9.788208	9.897222	9.890986	10.109014	10.102778	10.211792	7
54	9.788370	9.897123	9.891247	10.108753	10.102877	10.211630	6
55	9,788532	9.897025	9.891507	10.108493	10.102975	10.211468	5
56	9.788694	9.896926	9.891768	10.108232	10.103074	10.211306	4
57	9.788856	9 896828	9.892028	10.107972	10.103172	10.211144	3
58	9.789018	9.896729	9.892289	10.107711	10.103271	10.210982	2
59	9.789180	9.896631	9.892549	10.107451	10.103369	10.210820	1
60	9.789342	9.896532	9.892810	10.107190	10.103468	10.210658	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

52 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

38 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.789342	9.896532	9.892810	10.107190	10.103468	10.210658	60
1	9.789504	9.896433	9.893070	10.106930	10.103567	10.210496	59
2	9.789665	9.896335	9.893331	10.106669	10.103665	10.210335	58
3	9.789827	9.896236	9.893591	10.106409	10.103764	10.210173	57
4	9.789988	9.896137	9.893851	10.106149	10.103863	10.210012	56
5	9.790149	9.896038	9.894111	10.105889	10.103962	10.209851	55
6	9.790310	9.895939	9.894371	10.105629	10.104061	10.209690	54
7	9.790471	9.895840	9.894632	10.105368	10.104160	10.209529	53
8	9.790632	9.895741	9.894892	10.105108	10.104259	10.209368	52
9	9.790793	9.895641	9.895152	10.104848	10.104359	10.209207	51
10	9.790954	9.895542	9.895412	10.104588	10.104458	10.209046	50
11	9.791115	9.895443	9.895672	10.104328	10.104557	10.208885	49
12	9.791275	9.895343	9.895932	10.104068	10.104657	10.208725	48
13	9.791436	9.895244	9.896192	10.103808	10.104756	10.208564	47
14	9.791596	9.895145	9.896452	10.103548	10.104855	10.208404	46
15	9.791757	9.895045	9.896712	10.103288	10.104955	10.208243	45
16	9.791917	9.894945	9.896971	10.103029	10.105055	10.208083	44
17	9.792077	9.894846	9.897231	10.102769	10.105154	10.207923	43
18	9.792237	9.894746	9.897491	10.102509	10.105254	10.207763	42
19	9.792397	9.894646	9.897751	10.102249	10.105354	10.207603	41
20	9.792557	9.894546	9.898010	10.101990	10.105454	10.207443	40
21	9.792716	9.894446	9.898270	10.101730	10.105554	10.207284	39
22	9.792876	9.894346	9.898530	10.101470	10.105654	10.207124	38
23	9.793035	9.894246	9.898789	10.101211	10.105754	10.206965	37
24	9.793195	9.894146	9.899049	10.100951	10.105854	10.206805	36
25	9.793354	9.894046	9.899308	10.100692	10.105954	10.206646	35
26	9.793514	9.893946	9.899568	10.100432	10.106054	10.206486	34
27	9.793673	9.893846	9.899827	10.100173	10.106154	10.206327	33
28	9.793832	9.893745	9.900086	10.099914	10.106255	10.206168	32
29	9.793991	9.893645	9.900346	10.099654	10.106355	10.206009	31
30	9.794150	9.893544	9.900605	10.099395	10.106456	10.205850	30
31	9.794308	9.893444	9.900864	10.099136	10.106556	10.205692	29
32	9.794467	9.893343	9.901124	10.098876	10.106657	10.205533	28
33	9.794626	9.893243	9.901383	10.098617	10.106757	10.205374	27
34	9.794784	9.893142	9.901642	10.098358	10.106858	10.205216	26
35	9.794942	9.893041	9.901901	10.098099	10.106959	10.205058	25
36	9.795101	9.892940	9.902160	10.097840	10.107060	10.204899	24
37	9.795259	9.892839	9.902419	10.097581	10.107161	10.204741	23
38	9.795417	9.892739	9.902679	10.097321	10.107261	10.204583	22
39	9.795575	9.892638	9.902938	10.097062	10.107362	10.204425	21
40	9.795733	9.892536	9.903197	10.096803	10.107464	10.204267	20
41	9.795891	9.892435	9.903455	10.096545	10.107565	10.204109	19
42	9.796049	9.892334	9.903714	10.096286	10.107666	10.203951	18
43	9.796206	9.892233	9.903973	10.096027	10.107767	10.203794	17
44	9.796364	9.892132	9.904232	10.095768	10.107868	10.203636	16
45	9.796521	9.892030	9.904491	10.095509	10.107970	10.203479	15
46	9.796679	9.891929	9.904750	10.095250	10.108071	10.203321	14
47	9.796836	9.891827	9.905008	10.094992	10.108173	10.203164	13
48	9.796993	9.891726	9.905267	10.094733	10.108274	10.203007	12
49	9.797150	9.891624	9.905526	10.094474	10.108376	10.202850	11
50	9.797307	9.891523	9.905784	10.094216	10.108477	10.202693	10
51	9.797464	9.891421	9.906043	10.093957	10.108579	10.202536	9
52	9.797621	9.891319	9.906302	10.093698	10.108681	10.202379	8
53	9.797777	9.891217	9.906560	10.093440	10.108783	10.202223	7
54	9.797934	9.891115	9.906819	10.093181	10.108885	10.202066	6
55	9.798091	9.891013	9.907077	10.092923	10.108987	10.201909	5
56	9.798247	9.890911	9.907336	10.092664	10.109089	10.201753	4
57	9.798403	9.890809	9.907594	10.092406	10.109191	10.201597	3
58	9.798560	9.890707	9.907852	10.092148	10.109293	10.201440	2
59	9.798716	9.890605	9.908111	10.091889	10.109395	10.201284	1
60	9.798872	9.890503	9.908369	10.091631	10.109497	10.201128	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

51 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

39 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.798872	9.890503	9.908369	10.091631	10.109497	10.201128	60
1	9.799028	9.890400	9.908628	10.091372	10.109600	10.200972	59
2	9.799184	9.890298	9.908886	10.091114	10.109702	10.200816	58
3	9.799339	9.890195	9.909144	10.090856	10.109805	10.200661	57
4	9.799495	9.890093	9.909402	10.090598	10.109907	10.200505	56
5	9.799651	9.889990	9.909660	10.090340	10.110010	10.200349	55
6	9.799806	9.889888	9.909918	10.090082	10.110112	10.200194	54
7	9.799962	9.889785	9.910177	10.089823	10.110215	10.200038	53
8	9.800117	9.889682	9.910435	10.089565	10.110318	10.199883	52
9	9.800272	9.889579	9.910693	10.089307	10.110421	10.199728	51
10	9.800427	9.889477	9.910951	10.089049	10.110523	10.199573	50
11	9.800582	9.889374	9.911209	10.088791	10.110626	10.199418	49
12	9.800737	9.889271	9.911467	10.088533	10.110729	10.199263	48
13	9.800892	9.889168	9.911724	10.088276	10.110832	10.199108	47
14	9.801047	9.889064	9.911982	10.088018	10.110936	10.198953	46
15	9.801201	9.888961	9.912240	10.087760	10.111039	10.198799	45
16	9.801356	9.888858	9.912498	10.087502	10.111142	10.198644	44
17	9.801511	9.888755	9.912756	10.087244	10.111245	10.198489	43
18	9.801665	9.888651	9.913014	10.086986	10.111349	10.198335	42
19	9.801819	9.888548	9.913271	10.086729	10.111452	10.198181	41
20	9.801973	9.888444	9.913529	10.086471	10.111556	10.198027	40
21	9.802128	9.888341	9.913787	10.086213	10.111659	10.197872	39
22	9.802282	9.888237	9.914044	10.085956	10.111763	10.197718	38
23	9.802436	9.888134	9.914302	10.085698	10.111866	10.197564	37
24	9.802589	9.888030	9.914560	10.085440	10.111970	10.197411	36
25	9.802743	9.887926	9.914817	10.085183	10.112074	10.197257	35
26	9.802897	9.887822	9.915075	10.084925	10.112178	10.197103	34
27	9.803050	9.887718	9.915332	10.084668	10.112282	10.196950	33
28	9.803204	9.887614	9.915590	10.084410	10.112386	10.196796	32
29	9.803357	9.887510	9.915847	10.084153	10.112490	10.196643	31
30	9.803511	9.887406	9.916104	10.083896	10.112594	10.196489	30
31	9.803664	9.887302	9.916362	10.083638	10.112698	10.196336	29
32	9.803817	9.887198	9.916619	10.083381	10.112802	10.196183	28
33	9.803970	9.887093	9.916877	10.083123	10.112907	10.196030	27
34	9.804123	9.886989	9.917134	10.082866	10.113011	10.195877	26
35	9.804276	9.886885	9.917391	10.082609	10.113115	10.195724	25
36	9.804428	9.886780	9.917648	10.082352	10.113220	10.195572	24
37	9.804581	9.886676	9.917905	10.082095	10.113324	10.195419	23
38	9.804734	9.886571	9.918163	10.081837	10.113429	10.195266	22
39	9.804886	9.886466	9.918420	10.081580	10.113534	10.195114	21
40	9.805039	9.886362	9.918677	10.081323	10.113638	10.194961	20
41	9.805191	9.886257	9.918934	10.081066	10.113743	10.194809	19
42	9.805343	9.886152	9.919191	10.080809	10.113848	10.194657	18
43	9.805495	9.886047	9.919448	10.080552	10.113953	10.194505	17
44	9.805647	9.885942	9.919705	10.080295	10.114058	10.194353	16
45	9.805799	9.885837	9.919962	10.080038	10.114163	10.194201	15
46	9.805951	9.885732	9.920219	10.079781	10.114268	10.194049	14
47	9.806103	9.885627	9.920476	10.079524	10.114373	10.193897	13
48	9.806254	9.885522	9.920733	10.079267	10.114478	10.193746	12
49	9.806406	9.885416	9.920990	10.079010	10.114584	10.193594	11
50	9.806557	9.885311	9.921247	10.078753	10.114689	10.193443	10
51	9.806709	9.885205	9.921503	10.078497	10.114795	10.193291	9
52	9.806860	9.885100	9.921760	10.078240	10.114900	10.193140	8
53	9.807011	9.884994	9.922017	10.077983	10.115006	10.192989	7
54	9.807163	9.884889	9.922274	10.077726	10.115111	10.192837	6
55	9.807314	9.884783	9.922530	10.077470	10.115217	10.192686	5
56	9.807465	9.884677	9.922787	10.077213	10.115323	10.192535	4
57	9.807615	9.884572	9.923044	10.076956	10.115428	10.192385	3
58	9.807766	9.884466	9.923300	10.076700	10.115534	10.192234	2
59	9.807917	9.884360	9.923557	10.076443	10.115640	10.192083	1
60	9.808067	9.884254	9.923813	10.076187	10.115746	10.191933	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

50 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

40 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.808067	9.884254	9.923813	10.076187	10.115746	10.191933	60
1	9.808218	9.884148	9.924070	10.075930	10.115852	10.191782	59
2	9.808368	9.884042	9.924327	10.075673	10.115958	10.191632	58
3	9.808519	9.883936	9.924583	10.075417	10.116064	10.191481	57
4	9.808669	9.883829	9.924840	10.075160	10.116171	10.191331	56
5	9.808819	9.883723	9.925096	10.074904	10 116277	10.191181	55
6	9.808969	9.883617	9.925352	10.074648	10.116383	10.191031	54
7	9.809119	9.883510	9.925609	10.074391	10.116490	10.190881	53
8	9.809269	9.883404	9.925865	10.074135	10.116596	10.190731	52
9	9.809419	9.883297	9.926122	10.073878	10.116703	10.190581	51
10	9.809569	9.883191	9.926378	10.073622	10.116809	10.190431	50
11	9.809718	9.883084	9.926634	10.073366	10.116916	10.190282	49
12	9.809868	9.882977	9.926890	10.073110	10.117023	10.190132	48
13	9.810017	9.882871	9.927147	10.072853	10.117129	10.189983	47
14	9.810167	9.882764	9.927403	10.072597	10.117236	10.189833	46
15	9.810316	9.882657	9.927659	10.072341	10.117343	10.189684	45
16	9.810465	9.882550	9.927915	10.072085	10.117450	10.189535	44
17	9.810614	9.882443	9.928171	10.071829	10.117557	10.189386	43
18	9.810763	9.882336	9.928427	10.071573	10.117664	10.189237	42
19	9.810912	9.882229	9.928683	10.071317	10.117771	10.189088	41
20	9.811061	9.882121	9.928940	10.071060	10.117879	10.188939	40
21	9.811210	9.882014	9.929196	10.070804	10.117986	10.188790	39
22	9.811358	9.881907	9.929452	10.070548	10.118093	10.188642	38
23	9.811507	9.881799	9.929708	10.070292	10.118201	10.188493	37
24	9 811655	9.881692	9.929964	10.070036	10.118308	10.188345	36
25	9.811804	9.881584	9.930220	10.069780	10.118416	10.188196	35
26	9.811952	9.881477	9.930475	10.069525	10.118523	10.188048	34
27	9.812100	9.881369	9.930731	10.069269	10.118631	10.187900	33
28	9.812248	9.881261	9.930987	10 069013	10.118739	10.187752	32
29	9.812396	9.881153	9.931243	10.068757	10.118847	10.187604	31
30	9.812544	9.881046	9.931499	10 068501	10.118954	10.187456	30
31	9.812692	9.880938	9.931755	10.068245	10.119062	10.187308	29
32	9.812840	9.880830	9.932010	10.067990	10.119170	10.187160	28
33	9 812988	9.880722	9.932266	10.067734	10.119278	10.187012	27
34	9.813135	9.880613	9.932522	10.067478	10.119387	10.186365	26
35	9.813283	9.880505	9.932778	10.067222	10.119495	10.186717	25
36	9.813430	9.880397	9.933033	10.066967	10.119603	10.186570	24
37	9.813578	9.880289	9.933289	10.066711	10.119711	10.186422	23
38	9.813725	9.880180	9.933545	10.066455	10.119820	10.186275	22
39	9.813872	9.880072	9.933800	10.066200	10.119928	10.186128	21
40	9.814019	9.879963	9.934056	10.065944	10.120037	10.185981	20
41	9.814166	9.879855	9.934311	10.065689	10.120145	10.185834	19
42	9.814313	9.879746	9 934567	10.065433	10.120254	10.185687	18
43	9.814460	9.879637	9.934823	10.065177	10.120363	10.185540	17
44	9 814607	9.879529	9 935078	10.064922	10.120471	10.185393	16
45	9.814753	9.879420	9.935333	10.064667	10.120580	10.185247	15
46	9.814900	9.879311	9 935589	10.064411	10.120689	10.185100	14
47	9.815046	9.879202	9.935844	10.064156	10.120798	10.184954	13
48	9.815193	9.879093	9.936100	10.063900	10.120907	10.184807	12
49	9.815339	9.878984	9.936355	10.063645	10.121016	10.184661	11
50	9.815485	9.878875	9.936610	10.063390	10.121125	10.184515	10
51	9.815632	9.878766	9.936866	10.063134	10.121234	10.184368	9
52	9.815778	9.878656	9.937121	10.062879	10.121344	10.184222	8
53	9.815924	9.878547	9.937376	10.062624	10.121453	10.184076	7
54	9.816069	9.878438	9.937632	10.062368	10.121562	10.183931	6
55	9.816215	9.878328	9.937887	10.062113	10.121672	10.183785	5
56	9.816361	9.878219	9.938142	10.061858	10.121781	10.183639	4
57	9.816507	9.878109	9.938398	10.061602	10.121891	10.183493	3
58	9.816652	9.877999	9.938653	10.061347	10.122001	10.183348	2
59	9.816798	9.877890	9.938908	10.061092	10.122110	10.183202	1
60	9 816943	9 877780	9.939163	10.060837	10.122220	10.183057	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

49 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

41 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.816943	9.877780	9.939163	10.060837	10.122220	10.183057	60
1	9.817088	9.877670	9.939418	10.060582	10.122330	10.182912	59
2	9.817233	9.877560	9.939673	10.060327	10.122440	10.182767	58
3	9.817379	9.877450	9.939928	10.060072	10.122550	10.182621	57
4	9.817524	9.877340	9.940183	10.059817	10.122660	10.182476	56
5	9.817668	9.877230	9.940438	10.059562	10.122770	10.182332	55
6	9.817813	9.877120	9.940694	10.059306	10.122880	10.182187	54
7	9.817958	9.877010	9.940949	10.059051	10.122990	10.182042	53
8	9.818103	9.876899	9.941204	10.058796	10.123101	10.181897	52
9	9 818247	9.876789	9.941458	10.058542	10.123211	10.181753	51
10	9.818392	9.876678	9.941714	10.058286	10.123322	10.181608	50
11	9.818536	9.876568	9.941968	10.058032	10.123432	10.181464	49
12	9.818681	9.876457	9.942223	10.057777	10.123543	10.181319	48
13	9.818825	9.876347	9.942478	10.057522	10.123653	10.181175	47
14	9.818969	9.876236	9.942733	10.057267	10.123764	10.181031	46
15	9.819113	9.876125	9.942988	10.057012	10.123875	10.180887	45
16	9.819257	9.876014	9.943243	10.056757	10.123986	10.180743	44
17	9.819401	9.875904	9.943498	10.056502	10.124096	10.180599	43
18	9.819545	9.875793	9.943752	10.056248	10.124207	10.180455	42
19	9.819689	9 875682	9.944007	10.055993	10.124318	10.180311	41
20	9.819832	9 875571	9 944262	10.055738	10.124429	10.180168	40
21	9.819976	9.875459	9.944517	10.055483	10.124541	10.180024	39
22	9.820120	9.875348	9.944771	10.055229	10.124652	10.179880	38
23	9.820263	9.875237	9.945026	10.054974	10.124763	10.179737	37
24	9.820406	9.875126	9.945281	10.054719	10.124874	10.179594	36
25	9.820550	9.875014	9.945535	10.054465	10.124986	10.179450	35
26	9.820693	9.874903	9.945790	10.054210	10.125097	10.179307	34
27	9.820836	9.874791	9.946045	10.053955	10.125209	10.179164	33
28	9.820979	9.874680	9.946299	10.053701	10.125320	10.179021	32
29	9.821122	9.874568	9.946554	10.053446	10.125432	10.178878	31
30	9.821265	9.874456	9.946808	10.053192	10.125544	10.178735	30
31	9.821407	9.874344	9.947063	10.052937	10.125656	10.178593	29
32	9.821550	9.874232	9.947318	10.052682	10.125768	10.178450	28
33	9.821693	9.874121	9.947572	10.052428	10.125879	10.178307	27
34	9.821835	9.874009	9.947826	10.052174	10.125991	10.178165	26
35	9.821977	9.873896	9.948081	10.051919	10.126104	10.178023	25
36	9.822120	9.873784	9.948336	10.051664	10.126216	10.177880	24
37	9.822262	9.873672	9.948590	10.051410	10.126328	10.177738	23
38	9.822404	9.873560	9.948844	10.051156	10.126440	10.177596	22
39	9.822546	9.873448	9.949099	10.050901	10.126552	10.177454	21
40	9.822688	9.873335	9.949353	10.050647	10.126665	10.177312	20
41	9.822830	9.873223	9.949607	10.050393	10.126777	10.177170	19
42	9.822972	9.873110	9.949862	10.050138	10.126890	10.177028	18
43	9.823114	9.872998	9.950116	10.049884	10.127002	10.176886	17
44	9.823255	9.872885	9.950370	10.049630	10.127115	10.176745	16
45	9.823397	9.872772	9.950625	10.049375	10.127228	10.176603	15
46	9.823539	9.872659	9.950879	10.049121	10.127341	10.176461	14
47	9.823680	9.872547	9.951133	10.048867	10.127453	10.176320	13
48	9.823821	9.872434	9.951388	10.048612	10.127566	10.176179	12
49	9.823963	9.872321	9.951642	10.048358	10.127679	10.176037	11
50	9.824104	9.872208	9.951896	10.048104	10.127792	10.175896	10
51	9.824245	9.872095	9.952150	10.047850	10.127905	10.175755	9
52	9.824386	9.871981	9.952405	10.047595	10.128019	10.175614	8
53	9.824527	9.871868	9.952659	10.047341	10.128132	10.175473	7
54	9.824668	9.871755	9.952913	10.047087	10.128245	10.175332	6
55	9.824808	9.871641	9.953167	10.046833	10.128359	10.175192	5
56	9.824949	9.871528	9.953421	10.046579	10.128472	10.175051	4
57	9.825090	9.871414	9.953675	10.046325	10.128586	10.174910	3
58	9.825230	9.871301	9.953929	10.046071	10.128699	10.174770	2
59	9.825371	9.871187	9.954183	10.045817	10.128813	10.174629	1
60	9.825511	9.871073	9.954437	10.045563	10.128927	10.174489	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

48 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

42 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.825511	9.871073	9.954437	10.045563	10.128927	10.174489	60
1	9.825651	9.870960	9.954691	10.045309	10.129040	10.174349	59
2	9 825791	9 870846	9.954945	10.045055	10.129154	10.174209	58
3	9.825931	9.870732	9.955200	10.044800	10.129268	10.174069	57
4	9.826071	9.870618	9 955454	10.044546	10.129382	10.173929	56
5	9.826211	9.870504	9 955707	10.044293	10.129496	10.173789	55
6	9.826351	9.870390	9.955961	10.044039	10.129610	10.173649	54
7	9.826491	9.870276	9.956215	10.043785	10.129724	10.173509	53
8	9.826631	9.870161	9.956469	10.043531	10.129839	10.173369	52
9	9.826770	9.870047	9.956723	10.043277	10.129953	10.173230	51
10	9.826910	9.869933	9.956977	10.043023	10.130067	10.173090	50
11	9.827049	9.869818	9.957231	10.042769	10.130182	10.172951	49
12	9.827189	9.869704	9.957485	10.042515	10.130296	10.172811	48
13	9.827328	9.869589	9.957739	10.042261	10.130411	10.172672	47
14	9.827467	9.869474	9.957993	10.042007	10.130526	10.172533	46
15	9.827606	9.869360	9.958246	10.041754	10.130640	10.172394	45
16	9.827745	9.869245	9.958500	10.041500	10.130755	10.172255	44
17	9.827884	9.869130	9.958754	10.041246	10.130870	10.172116	43
18	9.828023	9.869015	9.959008	10.040992	10.130925	10.171977	42
19	9.828162	9.868900	9.959262	10.040738	10.131100	10.171838	41
20	9.828301	9.868785	9.959516	10.040484	10.131215	10.171699	40
21	9.828439	9.868670	9.959769	10.040231	10.131330	10.171561	39
22	9.828578	9.868555	9.960023	10.039977	10.131445	10.171422	38
23	9.828716	9.868440	9.960277	10.039723	10.131560	10.171284	37
24	9.828855	9.868324	9.960531	10.039469	10.131676	10.171145	36
25	9.828993	9.868209	9.960784	10.039216	10.131791	10.171007	35
26	9.829131	9.868093	9.961038	10.038962	10.131907	10.170869	34
27	9.829269	9.867978	9.961291	10.038709	10.132022	10.170731	33
28	9.829407	9 867862	9.961545	10.038455	10.132138	10.170593	32
29	9.829545	9.867747	9.961799	10.038201	10.132253	10.170455	31
30	9 829683	9.867631	9.962052	10.037948	10.132369	10.170317	30
31	9.829821	9.867515	9.962306	10.037694	10.132485	10.170179	29
32	9.829959	9.867399	9.962560	10.037440	10.132601	10.170041	28
33	9.830097	9.867283	9.962813	10.037187	10.132717	10.169903	27
34	9.830234	9.867167	9.963067	10.036933	10.132833	10.169766	26
35	9.830372	9.867051	9.963320	10.036680	10.132949	10.169628	25
36	9.830509	9.866935	9.963574	10.036426	10.133065	10.169491	24
37	9.830646	9.866819	9.963827	10.036173	10.133181	10.169354	23
38	9.830784	9.866703	9.964081	10.035919	10.133297	10.169216	22
39	9.830921	9.866586	9.964335	10.035665	10.133414	10.169079	21
40	9.831058	9.866470	9.964588	10.035412	10.133530	10.168942	20
41	9.831195	9.866353	9.964842	10.035158	10.133647	10.168805	19
42	9.831332	9.866237	9.965095	10.034905	10.133763	10.168668	18
43	9.831469	9.866120	9.965349	10.034651	10.133880	10.168531	17
44	9.831606	9.866004	9.965602	10.034398	10.133996	10.168394	16
45	9.831742	9.865887	9.965855	10.034145	10.134113	10.168258	15
46	9.831879	9.865770	9.966109	10.033891	10.134230	10.168121	14
47	9.832015	9.865653	9.966362	10.033638	10.134347	10.167985	13
48	9.832152	9.865536	9.966616	10.033384	10.134464	10.167848	12
49	9.832288	9.865419	9.966869	10.033131	10.134581	10.167712	11
50	9.832425	9.865302	9.967123	10.032877	10.134698	10.167575	10
51	9.832561	9.865185	9.967376	10.032624	10.134815	10.167439	9
52	9.832697	9.865068	9.967629	10.032371	10.134932	10.167303	8
53	9.832833	9.864950	9.967883	10.032117	10.135050	10.167167	7
54	9.832969	9.864833	9.968136	10.031864	10.135167	10.167031	6
55	9.833105	9.864716	9.968389	10.031611	10.135284	10.166895	5
56	9.833241	9.864598	9.968643	10.031357	10.135402	10.166759	4
57	9.833377	9.864481	9.968896	10.031104	10.135519	10.166623	3
58	9.833512	9.864363	9.969149	10.030851	10.135637	10.166488	2
59	9.833648	9.864245	9.969403	10.030597	10.135755	10.166352	1
60	9.833783	9.864127	9.969656	10.030344	10.135873	10.166217	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

47 Degrees.

TABLE II.

LOGARITHMIC SINES, TANGENTS, AND SECANTS.

43 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.833783	9.864127	9.969656	10.030344	10.135873	10.166217	60
1	9.833919	9.864010	9.969909	10.030091	10.135990	10.166081	59
2	9.834054	9.863892	9.970162	10.029838	10.136108	10.165946	58
3	9.834189	9.863774	9.970416	10.029584	10.136226	10.165811	57
4	9.834325	9.863656	9.970669	10.029331	10.136344	10.165675	56
5	9.834460	9.863538	9.970922	10.029078	10.136462	10.165540	55
6	9.834595	9.863419	9.971175	10.028825	10.136581	10.165405	54
7	9.834730	9.863301	9.971429	10.028571	10.136699	10.165270	53
8	9.834865	9.863183	9.971682	10.028318	10.136817	10.165135	52
9	9.834999	9.863064	9.971935	10.028065	10.136936	10.165001	51
10	9.835134	9.862946	9.972188	10.027812	10.137054	10.164866	50
11	9.835269	9.862827	9.972441	10.027559	10.137173	10.164731	49
12	9.835403	9.862709	9.972694	10.027306	10.137291	10.164597	48
13	9.835538	9.862590	9.972948	10.027052	10.137410	10.164462	47
14	9.835672	9.862471	9.973201	10.026799	10.137529	10.164328	46
15	9.835807	9.862353	9.973454	10.026546	10.137647	10.164193	45
16	9.835941	9.862234	9.973707	10.026293	10.137766	10.164059	44
17	9.836075	9.862115	9.973960	10.026040	10.137885	10.163925	43
18	9.836209	9.861996	9.974213	10.025787	10.138004	10.163791	42
19	9.836343	9.861877	9.974466	10.025534	10.138123	10.163657	41
20	9.836477	9.861758	9.974719	10.025281	10.138242	10.163523	40
21	9.836611	9.861638	9.974973	10.025027	10.138362	10.163389	39
22	9.836745	9.861519	9.975226	10.024774	10.138481	10.163255	38
23	9.836878	9.861400	9.975479	10.024521	10.138600	10.163122	37
24	9.837012	9.861280	9.975732	10.024268	10.138720	10.162988	36
25	9.837146	9.861161	9.975985	10.024015	10.138839	10.162854	35
26	9.837279	9.861041	9.976238	10.023762	10.138959	10.162721	34
27	9.837412	9.860922	9.976491	10.023509	10.139078	10.162588	33
28	9.837546	9.860802	9.976744	10.023256	10.139198	10.162454	32
29	9.837679	9.860682	9.976997	10.023003	10.139318	10.162321	31
30	9.837812	9.860562	9.977250	10.022750	10.139438	10.162188	30
31	9.837945	9.860442	9.977503	10.022497	10.139558	10.162055	29
32	9.838078	9.860322	9.977756	10.022244	10.139678	10.161922	28
33	9.838211	9.860202	9.978009	10.021991	10.139798	10.161789	27
34	9.838344	9.860082	9.978262	10.021738	10.139918	10.161656	26
35	9.838477	9.859962	9.978515	10.021485	10.140038	10.161523	25
36	9.838610	9.859842	9.978768	10.021232	10.140158	10.161390	24
37	9.838742	9.859721	9.979021	10.020979	10.140279	10.161258	23
38	9.838875	9.859601	9.979274	10.020726	10.140399	10.161125	22
39	9.839007	9.859480	9.979527	10.020473	10.140520	10.160993	21
40	9.839140	9.859360	9.979780	10.020220	10.140640	10.160860	20
41	9.839272	9.859239	9.980033	10.019967	10.140761	10.160728	19
42	9.839404	9.859119	9.980286	10.019714	10.140881	10.160596	18
43	9.839536	9.858998	9.980538	10.019462	10.141002	10.160464	17
44	9.839668	9.858877	9.980791	10.019209	10.141123	10.160332	16
45	9.839800	9.858756	9.981044	10.018956	10.141244	10.160200	15
46	9.839932	9.858635	9.981297	10.018703	10.141365	10.160068	14
47	9.840064	9.858514	9.981550	10.018450	10.141486	10.159936	13
48	9.840196	9.858393	9.981803	10.018197	10.141607	10.159804	12
49	9.840328	9.858272	9.982056	10.017944	10.141728	10.159672	11
50	9.840459	9.858151	9.982309	10.017691	10.141849	10.159541	10
51	9.840591	9.858029	9.982562	10.017438	10.141971	10.159409	9
52	9.840722	9.857908	9.982814	10.017186	10.142092	10.159278	8
53	9.840854	9.857786	9.983067	10.016933	10.142214	10.159146	7
54	9.840985	9.857665	9.983320	10.016680	10.142335	10.159015	6
55	9.841116	9.857543	9.983573	10.016427	10.142457	10.158884	5
56	9.841247	9.857422	9.983826	10.016174	10.142578	10.158753	4
57	9.841378	9.857300	9.984079	10.015921	10.142700	10.158622	3
58	9.841509	9.857178	9.984331	10.015669	10.142822	10.158491	2
59	9.841640	9.857056	9.984584	10.015416	10.142944	10.158360	1
60	9.841771	9.856934	9.984837	10.015163	10.143066	10.158229	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

46 Degrees.

TABLE II.

LOGARITHMIC SIGNS, TANGENTS AND SECANTS.

44 Degrees.

M.	Sine.	Co-sine.	Tangent.	Co-tang.	Secant.	Co-sec.	M.
0	9.841771	9.856934	9.984837	10.015163	10.143066	10.158229	60
1	9.841902	9.856812	9.985090	10.014910	10.143188	10.158098	59
2	9.842033	9.856690	9.985343	10.014657	10.143310	10.157967	58
3	9.842163	9.856568	9.985596	10.014404	10.143432	10.157837	57
4	9.842294	9.856446	9.985848	10.014152	10.143554	10.157706	56
5	9.842424	9.856323	9.986101	10.013899	10.143677	10.157576	55
6	9.842555	9.856201	9.986354	10.013646	10.143799	10.157445	54
7	9.842685	9.856078	9.986607	10.013393	10.143922	10.157315	53
8	9.842815	9.855956	9.986860	10.013140	10.144044	10.157185	52
9	9.842946	9.855833	9.987112	10.012888	10.144167	10.157054	51
10	9.843076	9.855711	9.987365	10.012635	10.144289	10.156924	50
11	9.843206	9.855588	9.987618	10.012382	10.144412	10.156794	49
12	9.843336	9.855465	9.987871	10.012129	10.144535	10.156664	48
13	9.843466	9.855342	9.988123	10.011877	10.144658	10.156534	47
14	9.843595	9.855219	9.988376	10.011624	10.144781	10.156405	46
15	9.843725	9.855096	9.988629	10.011371	10.144904	10.156275	45
16	9.843855	9.854973	9.988882	10.011118	10.145027	10.156145	44
17	9.843984	9.854850	9.989134	10.010866	10.145150	10.156016	43
18	9.844114	9.854727	9.989387	10.010613	10.145273	10.155886	42
19	9.844243	9.854603	9.989640	10.010360	10.145397	10.155757	41
20	9.844372	9.854480	9.989893	10.010107	10.145520	10.155628	40
21	9.844502	9.854356	9.990145	10.009855	10.145644	10.155498	39
22	9.844631	9.854233	9.990398	10.009602	10.145767	10.155369	38
23	9.844760	9.854109	9.990651	10.009349	10.145891	10.155240	37
24	9.844889	9.853986	9.990903	10.009097	10.146014	10.155111	36
25	9.845018	9.853862	9.991156	10.008844	10.146138	10.154982	35
26	9.845147	9.853738	9.991409	10.008591	10.146262	10.154853	34
27	9.845276	9.853614	9.991662	10.008338	10.146386	10.154724	33
28	9.845405	9.853490	9.991914	10.008086	10.146510	10.154595	32
29	9.845533	9.853366	9.992167	10.007833	10.146634	10.154467	31
30	9.845662	9.853242	9.992420	10.007580	10.146758	10.154338	30
31	9.845790	9.853118	9.992672	10.007328	10.146882	10.154210	29
32	9.845919	9.852994	9.992925	10.007075	10.147006	10.154081	28
33	9.846047	9.852869	9.993178	10.006822	10.147131	10.153953	27
34	9.846175	9.852745	9.993430	10.006570	10.147255	10.153825	26
35	9.846304	9.852620	9.993683	10.006317	10.147380	10.153696	25
36	9.846432	9.852496	9.993936	10.006064	10.147504	10.153568	24
37	9.846560	9.852371	9.994189	10.005811	10.147629	10.153440	23
38	9.846688	9.852247	9.994441	10.005559	10.147753	10.153312	22
39	9.846816	9.852122	9.994694	10.005306	10.147878	10.153184	21
40	9.846944	9.851997	9.994947	10.005053	10.148003	10.153056	20
41	9.847071	9.851872	9.995199	10.004801	10.148128	10.152929	19
42	9.847199	9.851747	9.995452	10.004548	10.148253	10.152801	18
43	9.847327	9.851622	9.995705	10.004295	10.148378	10.152673	17
44	9.847454	9.851497	9.995957	10.004043	10.148503	10.152546	16
45	9.847582	9.851372	9.996210	10.003790	10.148628	10.152418	15
46	9.847709	9.851246	9.996463	10.003537	10.148754	10.152291	14
47	9.847836	9.851121	9.996715	10.003285	10.148879	10.152164	13
48	9.847964	9.850996	9.996968	10.003032	10.149004	10.152036	12
49	9.848091	9.850870	9.997221	10.002779	10.149130	10.151909	11
50	9.848218	9.850745	9.997473	10.002527	10.149255	10.151782	10
51	9.848345	9.850619	9.997726	10.002274	10.149381	10.151655	9
52	9.848472	9.850493	9.997979	10.002021	10.149507	10.151528	8
53	9.848599	9.850368	9.998231	10.001769	10.149632	10.151401	7
54	9.848726	9.850242	9.998484	10.001516	10.149758	10.151274	6
55	9.848852	9.850116	9.998737	10.001263	10.149884	10.151148	5
56	9.848979	9.849990	9.998989	10.001011	10.150010	10.151021	4
57	9.849106	9.849864	9.999242	10.000758	10.150136	10.150894	3
58	9.849232	9.849738	9.999495	10.000505	10.150262	10.150768	2
59	9.849359	9.849611	9.999747	10.000253	10.150389	10.150641	1
60	9.849485	9.849485	0.000000	10.000000	10.150515	10.150515	0
M.	Co-sine.	Sine.	Co-tang.	Tangent.	Co-sec.	Secant.	M.

45 Degrees.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR ¼ POINT.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.0	61	60.9	03.0	121	120.9	05.9	181	180.8	08.9	241	240.7	11.8
2	02.0	00.1	62	61.9	03.0	122	121.9	06.0	182	181.8	08.9	242	241.7	11.9
3	03.0	00.1	63	62.9	03.1	123	122.9	06.0	183	182.8	09.0	243	242.7	11.9
4	04.0	00.2	64	63.9	03.1	124	123.9	06.1	184	183.8	09.0	244	243.7	12.0
5	05.0	00.2	65	64.9	03.2	125	124.9	06.1	185	184.8	09.1	245	244.7	12.0
6	06.0	00.3	66	65.9	03.2	126	125.8	06.2	186	185.8	09.1	246	245.7	12.1
7	07.0	00.3	67	66.9	03.3	127	126.8	06.2	187	186.8	09.2	247	246.7	12.1
8	08.0	00.4	68	67.9	03.3	128	127.8	06.3	188	187.8	09.2	248	247.7	12.2
9	09.0	00.4	69	68.9	03.4	129	128.8	06.3	189	188.8	09.3	249	248.7	12.2
10	10.0	00.5	70	69.9	03.4	130	129.8	06.4	190	189.8	09.3	250	249.7	12.3
11	11.0	00.5	71	70.9	03.5	131	130.8	06.4	191	190.8	09.4	251	250.7	12.3
12	12.0	00.6	72	71.9	03.5	132	131.8	06.5	192	191.8	09.4	252	251.7	12.4
13	13.0	00.6	73	72.9	03.6	133	132.8	06.5	193	192.8	09.5	253	252.7	12.4
14	14.0	00.7	74	73.9	03.6	134	133.8	06.6	194	193.8	09.5	254	253.7	12.5
15	15.0	00.7	75	74.9	03.7	135	134.8	06.6	195	194.8	09.6	255	254.7	12.5
16	16.0	00.8	76	75.9	03.7	136	135.8	06.7	196	195.8	09.6	256	255.7	12.6
17	17.0	00.8	77	76.9	03.8	137	136.8	06.7	197	196.8	09.7	257	256.7	12.6
18	18.0	00.9	78	77.9	03.8	138	137.8	06.8	198	197.8	09.7	258	257.7	12.7
19	19.0	00.9	79	78.9	03.9	139	138.8	06.8	199	198.8	09.8	259	258.7	12.7
20	20.0	01.0	80	79.9	03.9	140	139.8	06.9	200	199.8	09.8	260	259.7	12.8
21	21.0	01.0	81	80.9	04.0	141	140.8	06.9	201	200.8	09.9	261	260.7	12.8
22	22.0	01.1	82	81.9	04.0	142	141.8	07.0	202	201.8	09.9	262	261.7	12.9
23	23.0	01.1	83	82.9	04.1	143	142.8	07.0	203	202.8	10.0	263	262.7	12.9
24	24.0	01.2	84	83.9	04.1	144	143.8	07.1	204	203.8	10.0	264	263.7	13.0
25	25.0	01.2	85	84.9	04.2	145	144.8	07.1	205	204.8	10.1	265	264.7	13.0
26	26.0	01.3	86	85.9	04.2	146	145.8	07.2	206	205.8	10.1	266	265.7	13.1
27	27.0	01.3	87	86.9	04.3	147	146.8	07.2	207	206.8	10.2	267	266.7	13.1
28	28.0	01.4	88	87.9	04.3	148	147.8	07.3	208	207.8	10.2	268	267.7	13.2
29	29.0	01.4	89	88.9	04.4	149	148.8	07.3	209	208.8	10.3	269	268.7	13.2
30	30.0	01.5	90	89.9	04.4	150	149.8	07.4	210	209.8	10.3	270	269.7	13.3
31	31.0	01.5	91	90.9	04.5	151	150.8	07.4	211	210.7	10.4	271	270.7	13.3
32	32.0	01.6	92	91.9	04.5	152	151.8	07.5	212	211.7	10.4	272	271.7	13.3
33	33.0	01.6	93	92.9	04.6	153	152.8	07.5	213	212.7	10.5	273	272.7	13.4
34	34.0	01.7	94	93.9	04.6	154	153.8	07.6	214	213.7	10.5	274	273.7	13.4
35	35.0	01.7	95	94.9	04.7	155	154.8	07.6	215	214.7	10.6	275	274.7	13.5
36	36.0	01.8	96	95.9	04.7	156	155.8	07.7	216	215.7	10.6	276	275.7	13.5
37	37.0	01.8	97	96.9	04.8	157	156.8	07.7	217	216.7	10.7	277	276.7	13.6
38	38.0	01.9	98	97.9	04.8	158	157.8	07.8	218	217.7	10.7	278	277.7	13.6
39	39.0	01.9	99	98.9	04.9	159	158.8	07.8	219	218.7	10.8	279	278.7	13.7
40	40.0	02.0	100	99.9	04.9	160	159.8	07.9	220	219.7	10.8	280	279.7	13.7
41	41.0	02.0	101	100.9	05.0	161	160.8	07.9	221	220.7	10.8	281	280.7	13.8
42	41.9	02.1	102	101.9	05.0	162	161.8	08.0	222	221.7	10.9	282	281.7	13.8
43	42.9	02.1	103	102.9	05.1	163	162.8	08.0	223	222.7	10.9	283	282.7	13.9
44	43.9	02.2	104	103.9	05.1	164	163.8	08.1	224	223.7	11.0	284	283.7	13.9
45	44.9	02.2	105	104.9	05.2	165	164.8	08.1	225	224.7	11.0	285	284.7	14.0
46	45.9	02.3	106	105.9	05.2	166	165.8	08.2	226	225.7	11.1	286	285.7	14.0
47	46.9	02.3	107	106.9	05.3	167	166.8	08.2	227	226.7	11.1	287	286.7	14.1
48	47.9	02.4	108	107.9	05.3	168	167.8	08.2	228	227.7	11.2	288	287.7	14.1
49	48.9	02.4	109	108.9	05.4	169	168.8	08.3	229	228.7	11.2	289	288.7	14.2
50	49.9	02.5	110	109.9	05.4	170	169.8	08.3	230	229.7	11.3	290	289.7	14.2
51	50.9	02.5	111	110.9	05.5	171	170.8	08.4	231	230.7	11.3	291	290.7	14.3
52	51.9	02.6	112	111.9	05.5	172	171.8	08.4	232	231.7	11.4	292	291.7	14.3
53	52.9	02.6	113	112.9	05.5	173	172.8	08.5	233	232.7	11.4	293	292.7	14.4
54	53.9	02.7	114	113.9	05.6	174	173.8	08.5	234	233.7	11.5	294	293.6	14.4
55	54.9	02.7	115	114.9	05.6	175	174.8	08.6	235	234.7	11.5	295	294.6	14.5
56	55.9	02.8	116	115.9	05.7	176	175.8	08.6	236	235.7	11.6	296	295.6	14.5
57	56.9	02.8	117	116.9	05.7	177	176.8	08.7	237	236.7	11.6	297	296.6	14.6
58	57.9	02.9	118	117.9	05.8	178	177.8	08.7	238	237.7	11.7	298	497.6	14.6
59	58.9	02.9	119	118.9	05.8	179	178.8	08.8	239	238.7	11.7	299	298.6	14.7
60	59.9	02.9	120	119.9	05.9	180	179.8	08.8	240	239.7	11.8	300	299.6	14.7
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 7¾ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR ½ POINT.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.1	61	60.7	06.0	121	120.4	11.9	181	180.1	17.7	241	239.8	23.6
2	02.0	00.2	62	61.7	06.1	122	121.4	12.0	182	181.1	17.8	242	240.8	23.7
3	03.0	00.3	63	62.7	06.2	123	122.4	12.1	183	182.1	17.9	243	241.8	23.8
4	04.0	00.4	64	63.7	06.3	124	123.4	12.2	184	183.1	18.0	244	242.8	23.9
5	05.0	00.5	65	64.7	06.4	125	124.4	12.3	185	184.1	18.1	245	243.8	24.0
6	06.0	00.6	66	65.7	06.5	126	125.4	12.3	186	185.1	18.2	246	244.8	24.1
7	07.0	00.7	67	66.7	06.6	127	126.4	12.4	187	186.1	18.3	247	245.8	24.2
8	08.0	00.8	68	67.7	06.7	128	127.4	12.5	188	187.1	18.4	248	246.8	24.3
9	09.0	00.9	69	68.7	06.8	129	128.4	12.6	189	188.1	18.5	249	247.3	24.4
10	10.0	01.0	70	69.7	06.9	130	129.4	12.7	190	189.1	18.6	250	248.8	24.5
11	10.9	01.1	71	70.7	07.0	131	130.4	12.8	191	190.1	18.7	251	249.8	24.6
12	11.9	01.2	72	71.7	07.1	132	131.4	12.9	192	191.1	18.8	252	250.8	24.7
13	12.9	01.3	73	72.6	07.2	133	132.4	13.0	193	192.1	18.9	253	251.8	24.8
14	13.9	01.4	74	73.6	07.3	134	133.4	13.1	194	193.1	19.0	254	252.8	24.9
15	14.9	01.5	75	74.6	07.4	135	134.3	13.2	195	194.1	19.1	255	253.8	25.0
16	15.9	01.6	76	75.6	07.4	136	135.3	13.3	196	195.1	19.2	256	254.8	25.1
17	16.9	01.7	77	76.6	07.5	137	136.3	13.4	197	196.1	19.3	257	255.8	25.2
18	17.9	01.8	78	77.6	07.6	138	137.3	13.5	198	197.0	19.4	258	256.8	25.3
19	18.9	01.9	79	78.6	07.7	139	138.3	13.6	199	198.0	19.5	259	257.8	25.4
20	19.9	02.0	80	79.6	07.8	140	139.3	13.7	200	199.0	19.6	260	258.7	25.5
21	20.9	02.1	81	80.6	07.9	141	140.3	13.8	201	200.0	19.7	261	259.7	25.6
22	21.9	02.2	82	81.6	08.0	142	141.3	13.9	202	201.0	19.8	262	260.7	25.7
23	22.9	02.3	83	82.6	08.1	143	142.3	14.0	203	202.0	19.9	263	261.7	25.8
24	23.9	02.4	84	83.6	08.2	144	143.3	14.1	204	203.0	20.0	264	262.7	25.9
25	24.9	02.4	85	84.6	08.3	145	144.3	14.2	205	204.0	20.1	265	263.7	26.0
26	25.9	02.5	86	85.6	08.4	146	145.3	14.3	206	205.0	20.2	266	264.7	26.1
27	26.9	02.6	87	86.6	08.5	147	146.3	14.4	207	206.0	20.3	267	265.7	26.2
28	27.9	02.7	88	87.6	08.6	148	147.3	14.5	208	207.0	20.4	268	266.7	26.3
29	28.9	02.8	89	88.6	08.7	149	148.3	14.6	209	208.0	20.5	269	267.7	26.4
30	29.9	02.9	90	89.6	08.8	150	149.3	14.7	210	209.0	20.6	270	268.7	26.5
31	30.9	03.0	91	90.6	08.9	151	150.3	14.8	211	210.0	20.7	271	269.7	26.6
32	31.8	03.1	92	91.6	09.0	152	151.3	14.9	212	211.0	20.8	272	270.7	26.7
33	32.8	03.2	93	92.6	09.1	153	152.3	15.0	213	212.0	20.9	273	271.7	26.8
34	33.8	03.3	94	93.5	09.2	154	153.3	15.1	214	213.0	21.0	274	272.7	26.9
35	34.8	03.4	95	94.5	09.3	155	154.3	15.2	215	214.0	21.1	275	273.7	27.0
36	35.8	03.5	96	95.5	09.4	156	155.2	15.3	216	215.0	21.2	276	274.7	27.1
37	36.8	03.6	97	96.5	09.5	157	156.2	15.4	217	216.0	21.3	277	275.7	27.2
38	37.8	03.7	98	97.5	09.6	158	157.2	15.5	218	216.9	21.4	278	276.7	27.3
39	38.8	03.8	99	98.5	09.7	159	158.2	15.6	219	217.9	21.5	279	277.7	27.3
40	39.8	03.9	100	99.5	09.8	160	159.2	15.7	220	218.9	21.6	280	278.7	27.4
41	40.8	04.0	101	100.5	09.9	161	160.2	15.8	221	219.9	21.7	281	279.6	27.5
42	41.8	04.1	102	101.5	10.0	162	161.2	15.9	222	220.9	21.8	282	280.6	27.6
43	42.8	04.2	103	102.5	10.1	163	162.2	16.0	223	221.9	21.9	283	281.6	27.7
44	43.8	04.3	104	103.5	10.2	164	163.2	16.1	224	222.9	22.0	284	282.6	27.8
45	44.8	04.4	105	104.5	10.3	165	164.2	16.2	225	223.9	22.1	285	283.6	27.9
46	45.8	04.5	106	105.5	10.4	166	165.2	16.3	226	224.9	22.2	286	284.6	28.0
47	46.8	04.6	107	106.5	10.5	167	166.2	16.4	227	225.9	22.2	287	285.6	28.1
48	47.8	04.7	108	107.5	10.6	168	167.2	16.5	228	226.9	22.3	288	286.6	28.2
49	48.8	04.8	109	108.5	10.7	169	168.2	16.6	229	227.9	22.4	289	287.6	28.3
50	49.8	04.9	110	109.5	10.8	170	169.2	16.7	230	228.9	22.5	290	288.6	28.4
51	50.8	05.0	111	110.5	10.9	171	170.2	16.8	231	229.9	22.6	291	289.6	28.5
52	51.7	05.1	112	111.5	11.0	172	171.2	16.9	232	230.9	22.7	292	290.6	28.6
53	52.7	05.2	113	112.5	11.1	173	172.2	17.0	233	231.9	22.8	293	291.6	28.7
54	53.7	05.3	114	113.5	11.2	174	173.2	17.1	234	232.9	22.9	294	292.6	28.8
55	54.7	05.4	115	114.4	11.3	175	174.2	17.2	235	233.9	23.0	295	293.6	28.9
56	55.7	05.5	116	115.4	11.4	176	175.2	17.3	236	234.9	23.1	296	294.6	29.0
57	56.7	05.6	117	116.4	11.5	177	176.1	17.4	237	235.9	23.2	297	295.6	29.1
58	57.7	05.7	118	117.4	11.6	178	177.1	17.4	238	236.9	23.3	298	296.6	29.2
59	58.7	05.8	119	118.4	11.7	179	178.1	17.5	239	237.8	23.4	299	297.6	29.3
60	59.7	05.9	120	119.4	11.8	180	179.1	17.6	240	238.8	23.5	300	298.6	29.4
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 7½ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR ¾ POINT.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.1	61	60.3	09.0	121	119.7	17.8	181	179.0	26.6	241	238.4	35.4
2	02.0	00.3	62	61.3	09.1	122	120.7	17.9	182	180.0	26.7	242	239.4	35.5
3	03.0	00.4	63	62.3	09.2	123	121.7	18.1	183	181.0	26.9	243	240.4	35.7
4	04.0	00.6	64	63.3	08.4	124	122.7	18.2	184	182.0	27.0	244	241.4	35.8
5	04.9	00.7	65	64.3	09.5	125	123.7	18.3	185	183.0	27.2	245	242.4	36.0
6	05.9	00.9	66	65.3	09.7	126	124.6	18.5	186	184.0	27.3	246	243.3	36.1
7	06.9	01.0	67	66.3	09.8	127	125.6	18.6	187	185.0	27.4	247	244.3	36.2
8	07.9	01.2	68	67.3	10.0	128	126.6	18.8	188	186.0	27.6	248	245.3	36.4
9	08.9	01.3	69	68.3	10.1	129	127.6	18.9	189	187.0	27.7	249	246.3	36.5
10	09.9	01.5	70	69.2	10.3	130	128.6	19.1	190	187.9	27.9	250	247.3	36.7
11	10.9	01.6	71	70.2	10.4	131	129.6	19.2	191	188.9	28.0	251	148.3	36.8
12	11.9	01.8	72	71.2	10.6	132	130.6	19.4	192	189.9	28.2	252	249.3	37.0
13	12.9	01.9	73	72.2	10.7	133	131.6	19.5	193	190.9	28.3	253	250.3	37.1
14	13.9	02.1	74	73.2	10.9	134	132.6	19.7	194	191.9	28.5	254	251.3	37.3
15	14.8	02.2	75	74.2	11.0	135	133.5	19.8	195	192.9	28.6	255	252.2	37.4
16	15.8	02.3	76	75.2	11.2	136	134.5	20.0	196	193.9	28.8	256	253.2	37.6
17	16.8	02.5	77	76.2	11.3	137	135.5	20.1	197	194.9	28.9	257	254.2	37.7
18	17.8	02.6	78	77.2	11.4	138	136.5	20.3	198	195.9	29.1	258	255.2	37.9
19	18.8	02.8	79	78.1	11.6	139	137.5	20.4	199	196.8	29.2	259	256.2	38.0
20	19.8	02.9	80	79.1	11.7	140	138.5	20.5	200	197.8	29.4	260	257.2	38.2
21	20.8	03.1	81	80.1	11.9	141	139.5	20.7	201	198.8	29.5	261	258.2	38.3
22	21.8	03.2	82	81.1	12.0	142	140.5	20.8	202	199.8	29.6	262	259.2	38.4
23	22.8	03.4	83	82.1	12.2	143	141.5	21.0	203	200.8	29.8	263	260.2	38.6
24	23.7	03.5	84	83.1	12.3	144	142.4	21.1	204	201.8	29.9	264	261.1	38.7
25	24.7	03.7	85	84.1	12.5	145	143.4	21.3	205	202.8	30.1	265	262.1	38.9
26	25.7	03.8	86	85.1	12.6	146	144.4	21.4	206	203.8	30.2	266	263.1	39.0
27	26.7	04.0	87	86.1	12.8	147	145.4	21.6	207	204.8	30.4	267	264.1	39.2
28	27.7	04.1	88	87.1	12.9	148	146.4	21.7	208	205.8	30.5	268	265.1	39.3
29	28.7	04.3	89	88.0	13.1	149	147.4	21.9	209	206.7	30.7	269	266.1	39.5
30	29.7	04.4	90	89.0	13.2	150	148.4	22.0	210	207.7	30.8	270	267.1	39.6
31	30.7	04.6	91	90.0	13.4	151	149.4	22.2	211	208.7	31.0	271	268.1	39.8
32	31.7	04.7	92	91.0	13.5	152	150.4	22.3	212	209.7	31.1	272	269.1	39.9
33	32.6	04.8	93	92.0	13.7	153	151.3	22.5	213	210.7	31.3	273	270.0	40.1
34	33.6	05.0	94	93.0	13.8	154	152.3	22.6	214	211.7	31.4	274	271.0	40.2
35	34.6	05.1	95	94.0	13.9	155	153.3	22.7	215	212.7	31.6	275	272.0	40.4
36	35.6	05.3	96	95.0	14.1	156	154.3	22.9	216	213.7	31.7	276	273.0	40.5
37	36.6	05.4	97	96.0	14.2	157	155.3	23.0	217	214.7	31.8	277	274.0	40.6
38	37.6	05.6	98	96.9	14.4	158	156.3	23.2	218	215.6	32.0	278	275.0	40.8
39	38.6	05.7	99	97.9	14.5	159	157.3	23.3	219	216.6	32.1	279	276.0	40.9
40	39.6	05.9	100	98.9	14.7	160	158.3	23.5	220	217.6	32.3	280	277.0	41.1
41	40.6	06.0	101	99.9	14.8	161	159.3	23.6	221	218.6	32.4	281	278.0	41.2
42	41.6	06.2	102	100.9	15.0	162	160.3	23.8	222	219.6	32.6	282	279.0	41.4
43	42.5	06.3	103	101.9	15.1	163	161.2	23.9	223	220.6	32.7	283	279.9	41.5
44	43.5	06.5	104	102.9	15.3	164	162.2	24.1	224	221.6	32.9	284	280.9	41.7
45	44.5	06.6	105	103.9	15.4	165	163.2	24.2	225	222.6	33.0	285	281.9	41.8
46	45.5	06.8	106	104.9	15.6	166	164.2	24.4	226	223.6	33.2	286	282.9	42.0
47	46.5	06.9	107	105.8	15.7	167	165.2	24.5	227	224.5	33.3	287	283.9	42.1
48	47.5	07.0	108	106.8	15.9	168	166.2	24.7	228	225.5	33.5	288	284.9	42.3
49	48.5	07.2	109	107.8	16.0	169	167.2	24.8	229	226.5	33.6	289	285.9	42.4
50	49.5	07.3	110	108.8	16.1	170	168.2	24.9	230	227.5	33.8	290	286.9	42.6
51	50.5	07.5	111	109.8	16.3	171	169.2	25.1	231	228.5	33.9	291	287.9	42.7
52	51.4	07.6	112	110.8	16.4	172	170.1	25.3	232	229.5	34.0	292	288.8	42.9
53	52.4	07.8	113	111.8	16.6	173	171.1	25.4	233	230.5	34.2	293	289.8	43.0
54	53.4	07.9	114	112.8	16.7	174	172.1	25.5	234	231.5	34.3	294	290.8	43.1
55	54.4	08.1	115	113.8	16.9	175	173.1	25.7	235	232.5	34.5	295	291.8	43.3
56	55.4	08.2	116	114.7	17.0	176	174.1	25.8	236	233.4	34.6	296	292.8	43.4
57	56.4	08.4	117	115.7	17.2	177	175.1	26.0	237	234.4	34.8	297	293.8	43.6
58	57.4	08.5	118	116.7	17.3	178	176.1	26.1	238	235.4	34.9	298	294.8	43.7
59	58.4	08.7	119	117.7	17.5	179	177.1	26.3	239	236.4	35.1	299	295.8	43.9
60	59.4	08.8	120	118.7	17.6	180	178.1	26.4	240	237.4	35.2	300	296.8	44.0
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 7¼ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 1 POINT.

Dep	Lat.	Dist.	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.2	61	59.8	11.9	121	118.7	23.6	181	177.5	35.3	241	236.4	47.0
2	02.0	00.4	62	60.8	12.1	122	119.7	23.8	182	178.5	35.5	242	237.4	47.2
3	02.9	00.6	63	61.8	12.3	123	120.6	24.0	183	179.5	35.7	243	238.3	47.4
4	03.9	00.8	64	62.8	12.5	124	121.6	24.2	184	180.5	35.9	244	239.3	47.6
5	04.9	01.0	65	63.8	12.7	125	122.6	24.4	185	181.5	36.1	215	240.3	47.8
6	05.9	01.2	66	64.7	12.9	126	123.6	24.6	186	182.4	36.3	246	241.3	48.0
7	06.9	01.4	67	65.7	13.1	127	124.6	24.8	187	183.4	36.5	247	242.3	48.2
8	07.8	01.6	68	66.7	13.3	128	125.5	25.0	188	184.4	36.7	248	243.2	48.4
9	08.8	01.8	69	67.7	13.5	129	126.5	25.2	189	185.4	36.9	249	244.2	48.6
10	09.8	02.0	70	68.7	13.7	130	127.5	25.4	190	186.4	37.1	250	215.2	48.8
11	10.8	02.2	71	69.6	13.9	131	128.5	25.6	191	187.3	37.3	251	246.2	49.0
12	11.8	02.3	72	70.6	14.0	132	129.5	25.8	192	188.3	37.5	252	247.2	49.2
13	12.8	02.5	73	71.6	14.2	133	130.5	26.0	193	189.3	37.7	253	248.1	49.4
14	13.7	02.7	74	72.6	11.4	134	131.4	26.1	194	190.3	37.8	254	249.1	49.6
15	14.7	02.9	75	73.6	14.6	135	132.4	26.3	195	191.3	38.0	255	250.1	49.7
16	15.7	03.1	76	74.5	14.8	136	133.4	26.5	196	192.2	38.2	256	251.1	49.9
17	16.7	03.3	77	75.5	15.0	137	134.4	26.7	197	193.2	38.4	257	252.1	50.1
18	17.7	03.5	78	76.5	15.2	138	135.4	26.9	198	194.2	38.6	258	253.0	50.3
19	18.6	03.7	79	77.5	15.4	139	136.3	27.1	199	195.2	38.8	259	254.0	50.5
20	19.6	03.9	80	78.5	15.6	140	137.3	27.3	200	196.2	39.0	260	255.0	50.7
21	20.6	04.1	81	79.4	15.8	141	138.3	27.5	201	197.1	39.2	261	256.0	50.9
22	21.6	04.3	82	80.4	16.0	142	139.3	27.7	202	198.1	39.4	262	257.0	51.1
23	22.6	04.5	83	81.4	16.2	143	140.3	27.9	203	199.1	39.6	263	258.0	51.3
24	23.5	04.7	84	82.4	16.4	144	141.2	28.1	204	200.1	39.8	264	258.9	51.5
25	24.5	04.9	85	83.4	16.6	145	142.2	28.3	205	201.1	40.0	265	259.9	51.7
26	25.5	05.1	86	84.4	16.8	146	143.2	28.5	206	202.0	40.2	266	260.9	51.9
27	26.5	05.3	87	85.3	17.0	147	144.2	28.7	207	203.0	40.4	267	261.9	52.1
28	27.5	05.5	88	86.3	17.2	148	145.2	28.9	208	204.0	40.6	268	262.9	52.3
29	28.4	05.7	89	87.3	17.4	149	146.1	29.1	209	205.0	40.8	269	263.8	52.5
30	29.4	05.9	90	88.3	17.6	150	147.1	29.3	210	206.0	41.0	270	264.8	52.7
31	30.4	06.0	91	89.3	17.8	151	148.1	29.5	211	207.0	41.2	271	265.8	52.9
32	31.4	06.2	92	90.2	18.0	152	149.1	29.7	212	207.9	41.4	272	266.8	53.1
33	32.4	06.4	93	91.2	18.1	153	150.1	29.9	213	208.9	41.6	273	267.8	53.3
34	33.4	06.6	94	92.2	18.3	154	151.0	30.0	214	209.9	41.8	274	268.7	53.5
35	34.3	06.8	95	93.2	18.5	155	152.0	30.2	215	210.9	41.9	275	269.7	53.6
36	35.3	07.0	96	94.2	18.7	156	153.0	30.4	216	211.9	42.1	276	270.7	53.8
37	36.3	07.2	97	95.1	18.9	157	154.0	30.6	217	212.8	42.3	277	271.7	54.0
38	37.3	07.4	98	96.1	19.1	158	155.0	30.8	218	213.8	42.5	278	272.7	54.2
39	38.3	07.6	99	97.1	19.3	159	156.0	31.0	219	214.8	42.7	279	273.6	54.4
40	39.2	07.8	100	98.1	19.5	160	156.9	31.2	220	215.8	42.9	280	274.6	54.6
41	40.2	08.0	101	99.1	19.7	161	157.9	31.4	221	216.8	43.1	281	275.6	54.8
42	41.2	08.2	102	100.0	19.9	162	158.9	31.6	222	217.7	43.3	282	276.6	55.0
43	42.2	08.4	103	101.0	20.1	163	159.9	31.8	223	218.7	43.5	283	277.6	55.2
44	43.2	08.6	104	102.0	20.3	164	160.9	32.0	224	219.7	43.7	284	278.5	55.4
45	44.1	08.8	105	103.0	20.5	165	161.8	32.2	225	220.7	43.9	285	279.5	55.6
46	45.1	09.0	106	104.0	20.7	166	162.8	32.4	226	221.7	44.1	286	280.5	55.8
47	46.1	09.2	107	104.9	20.9	167	163.8	32.6	227	222.6	44.3	287	281.5	56.0
48	47.1	09.4	108	105.9	21.1	168	164.8	32.8	228	223.6	44.5	288	282.5	56.2
49	48.1	09.6	109	106.9	21.3	169	165.8	33.0	229	224.6	44.7	289	283.5	56.4
50	49.0	09.8	110	107.9	21.5	170	166.7	33.2	230	225.6	44.9	290	284.4	56.6
51	50.0	10.0	111	108.9	21.7	171	167.7	33.4	231	226.6	45.1	291	285.4	56.8
52	51.0	10.1	112	109.9	21.9	172	168.7	33.6	232	227.5	45.3	292	286.4	57.0
53	52.0	10.3	113	110.8	22.0	173	169.7	33.8	233	228.5	45.5	293	287.4	57.2
54	53.0	10.5	114	111.8	22.2	174	170.7	34.0	234	229.5	45.7	294	288.4	57.4
55	53.9	10.7	115	112.8	22.4	175	171.6	34.1	235	230.5	45.9	295	289.3	57.6
56	54.9	10.9	116	113.8	22.6	176	172.6	34.3	236	231.5	46.0	296	290.3	57.7
57	55.9	11.1	117	114.8	22.8	177	173.6	34.5	237	232.5	46.2	297	291.3	57.9
58	56.9	11.3	118	115.7	23.0	178	174.6	34.7	238	233.4	46.4	298	292.3	58.1
59	57.9	11.5	119	116.7	23.2	179	175.6	34.9	239	234.4	46.6	299	293.3	58.3
60	58.8	11.7	120	117.7	23.4	180	176.5	35.1	240	235.4	46.8	300	294.2	58.5
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 7 Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 1¼ POINT.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.2	61	59.2	14.8	121	117.4	29.4	181	175.6	44.0	241	233.8	58.6
2	01.9	00.5	62	60.1	15.1	122	118.4	29.6	182	176.5	44.2	242	234.8	58.8
3	02.9	00.7	63	61.1	15.3	123	119.3	29.9	183	177.5	44.5	243	235.7	59.0
4	03.9	01.0	64	62.1	15.6	124	120.3	30.1	184	178.5	44.7	244	236.7	59.3
5	04.9	01.2	65	63.1	15.8	125	121.3	30.4	185	179.5	45.0	245	237.7	59.5
6	05.8	01.5	66	64.0	16.0	126	122.2	30.6	186	180.4	45.2	246	238.6	59.8
7	06.8	01.7	67	65.0	16.3	127	123.2	30.9	187	181.4	45.4	247	239.6	60.0
8	07.8	01.9	68	66.0	16.5	128	124.2	31.1	188	182.4	45.7	248	240.6	60.3
9	08.7	02.2	69	66.9	16.8	129	125.1	31.3	189	183.3	45.9	249	241.6	60.5
10	09.7	02.4	70	67.9	17.0	130	126.1	31.6	190	184.3	46.2	250	242.5	60.8
11	10.7	02.7	71	68.9	17.3	131	127.1	31.8	191	185.3	46.4	251	243.5	61.0
12	11.6	02.9	72	69.9	17.5	132	128.1	32.1	192	186.2	46.7	252	244.5	61.2
13	12.6	03.2	73	70.8	17.7	133	129.0	32.3	193	187.2	46.9	253	245.4	61.5
14	13.6	03.4	74	71.8	18.0	134	130.0	32.6	194	188.2	47.1	254	256.4	61.7
15	14.6	03.6	75	72.8	18.2	135	131.0	32.8	195	189.2	47.4	255	247.4	62.0
16	15.5	03.9	76	73.7	18.5	136	131.9	33.1	196	190.1	47.6	256	248.3	62.2
17	16.5	04.1	77	74.7	18.7	137	132.9	33.3	197	191.1	47.9	257	249.3	62.5
18	17.5	04.4	78	75.7	19.0	138	133.9	33.5	198	192.1	48.1	258	250.3	62.7
19	18.4	04.6	79	76.6	19.2	139	134.8	33.8	199	193.0	48.4	259	251.3	62.9
20	19.4	04.9	80	77.6	19.4	140	135.8	34.0	200	194.0	48.6	260	252.2	63.2
21	20.4	05.1	81	78.6	19.7	141	136.8	34.3	201	195.0	48.8	261	253.2	63.4
22	21.3	05.4	82	79.6	19.9	142	137.8	34.5	202	196.0	49.1	262	254.2	63.7
23	22.3	05.6	83	80.5	20.2	143	138.7	34.8	203	196.9	49.3	263	255.1	63.9
24	23.3	05.8	84	81.5	20.4	144	139.7	35.0	204	197.9	49.6	264	256.1	64.2
25	24.3	06.1	85	82.5	20.7	145	140.7	35.2	205	198.9	49.8	265	257.1	64.4
26	25.2	06.3	86	83.4	20.9	146	141.6	35.5	206	199.8	50.1	266	258.0	64.6
27	26.2	06.6	87	84.4	21.1	147	142.6	35.7	207	200.8	50.3	267	259.0	64.9
28	27.2	06.8	88	85.4	21.4	148	143.6	36.0	208	201.8	50.5	268	260.0	65.1
29	28.1	07.1	89	86.3	21.6	149	144.5	36.2	209	202.7	50.8	269	261.0	65.4
30	29.1	07.3	90	87.3	21.9	150	145.5	36.5	210	203.7	51.0	270	261.9	65.6
31	30.1	07.5	91	88.3	22.1	151	146.5	36.7	211	204.7	51.3	271	262.9	65.9
32	31.0	07.8	92	89.3	22.4	152	147.4	36.9	212	205.7	51.5	272	263.9	66.1
33	32.0	08.0	93	90.2	22.6	153	148.4	37.2	213	206.6	51.8	273	264.8	66.3
34	33.0	08.3	94	91.2	22.8	154	149.4	37.4	214	207.6	52.0	274	265.8	66.6
35	34.0	08.5	95	92.2	23.1	155	150.4	37.7	215	208.6	52.2	275	266.8	66.8
36	34.9	08.8	96	93.1	23.3	156	151.3	37.9	216	209.5	52.5	276	267.7	67.1
37	35.9	09.0	97	94.1	23.6	157	152.3	38.2	217	210.5	52.7	277	268.7	67.3
38	36.9	09.2	98	95.1	23.8	158	153.3	38.4	218	211.5	53.0	278	269.7	67.6
39	37.8	09.5	99	96.0	24.1	159	154.2	38.6	219	212.5	53.2	279	270.7	67.8
40	38.8	09.7	100	97.0	24.3	160	155.2	38.9	220	213.4	53.5	280	271.6	68.0
41	39.8	10.0	101	98.0	24.5	161	156.2	39.1	221	214.4	53.7	281	272.6	68.3
42	40.7	10.2	102	99.0	24.8	162	157.2	39.4	222	215.4	53.9	282	273.6	68.5
43	41.7	10.5	103	99.9	25.0	163	158.1	39.6	223	216.3	54.2	283	274.5	68.8
44	42.7	10.7	104	100.9	25.3	164	159.1	39.9	224	217.3	54.4	284	275.5	69.0
45	43.7	10.9	105	101.9	25.5	165	160.1	40.1	225	218.3	54.7	285	276.5	69.3
46	44.6	11.2	106	102.8	25.8	166	161.0	40.3	226	219.2	54.9	286	277.4	69.5
47	45.6	11.4	107	103.8	26.0	167	162.0	40.6	227	220.2	55.2	287	278.4	69.7
48	46.6	11.7	108	104.8	26.2	168	163.0	40.8	228	221.2	55.4	288	279.4	70.0
49	47.5	11.9	109	105.7	26.5	169	163.9	41.1	229	222.2	55.6	289	280.4	70.2
50	48.5	12.2	110	106.7	26.7	170	164.9	41.3	230	223.1	55.9	290	281.3	70.5
51	49.5	12.4	111	107.7	27.0	171	165.9	41.6	231	224.1	56.1	291	282.3	70.7
52	50.4	12.6	112	108.7	27.2	172	166.9	41.8	232	225.1	56.4	292	283.3	71.0
53	51.4	12.9	113	109.6	27.5	173	167.8	42.0	233	226.0	56.6	293	284.2	71.2
54	52.4	13.1	114	110.6	27.7	174	168.8	42.3	234	227.0	56.9	294	285.2	71.4
55	53.4	13.4	115	111.6	27.9	175	169.8	42.5	235	228.0	57.1	295	286.2	71.7
56	54.3	13.6	116	112.5	28.2	176	170.7	42.8	236	228.9	57.3	296	287.1	71.9
57	55.3	13.9	117	113.5	28.4	177	171.7	43.0	237	229.9	57.6	297	288.1	72.2
58	56.3	14.1	118	114.5	28.7	178	172.7	43.3	238	230.9	57.8	298	289.1	72.4
59	57.2	14.3	119	115.4	28.9	179	173.6	43.5	239	231.8	58.1	299	290.1	72.7
60	58.2	14.6	120	116.4	29.2	180	174.6	43.7	240	232.8	58.3	300	291.0	72.9
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 6¾ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 1½ POINT.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.3	61	58.4	17.7	121	115.8	35.1	181	173.2	52.5	241	230.6	70.0
2	01.9	00.6	62	59.3	18.0	122	116.8	35.4	182	174.2	52.8	242	231.6	70.3
3	02.9	00.9	63	60.3	18.3	123	117.7	35.7	183	175.1	53.1	243	232.5	70.5
4	03.8	01.2	64	61.2	18.6	124	118.7	36.0	184	176.1	53.4	244	233.5	70.8
5	04.8	01.5	65	62.2	18.9	125	119.6	36.3	185	177.0	53.7	245	234.5	71.1
6	05.7	01.7	66	63.2	19.2	126	120.6	36.6	186	178.0	54.0	246	235.4	71.4
7	06.7	02.0	67	64.1	19.5	127	121.5	36.9	187	179.0	54.3	247	236.4	71.7
8	07.7	02.3	68	65.1	19.7	128	122.5	37.2	188	179.9	54.6	248	237.3	72.0
9	08.6	02.6	69	66.0	20.0	129	123.5	37.5	189	180.9	54.9	249	238.3	72.3
10	09.6	02.9	70	67.0	20.3	130	124.4	37.7	190	181.8	55.2	250	239.2	72.6
11	10.5	03.2	71	67.9	20.6	131	125.4	38.0	191	182.8	55.4	251	240.2	72.9
12	11.5	03.5	72	68.9	20.9	132	126.3	38.3	192	183.7	55.7	252	241.2	73.2
13	12.4	03.8	73	69.9	21.2	133	127.3	38.6	193	184.7	56.0	253	242.1	73.4
14	13.4	04.1	74	70.8	21.5	134	128.2	38.9	194	185.7	56.3	254	243.1	73.7
15	14.4	04.4	75	71.8	21.8	135	129.2	39.2	195	186.6	56.6	255	244.0	74.0
16	15.3	04.6	76	72.7	22.1	136	130.1	39.5	196	187.6	56.9	256	245.0	74.3
17	16.3	04.9	77	73.7	22.4	137	131.1	39.8	197	188.5	57.2	257	245.9	74.6
18	17.2	05.2	78	74.6	22.6	138	132.1	40.1	198	189.5	57.5	258	246.9	74.9
19	18.2	05.5	79	75.6	22.9	139	133.0	40.4	199	190.4	57.8	259	247.9	75.2
20	19.1	05.8	80	76.6	23.2	140	134.0	40.6	200	191.4	58.1	260	248.8	75.5
21	20.1	06.1	81	77.5	23.5	141	134.9	40.9	201	192.3	58.4	261	249.8	75.8
22	21.1	06.4	82	78.5	23.8	142	135.9	41.2	202	193.3	58.6	262	250.7	76.1
23	22.0	06.7	83	79.4	24.1	143	136.8	41.5	203	194.3	58.9	263	251.7	76.3
24	23.0	07.0	84	80.4	24.4	144	137.8	41.8	204	195.2	59.2	264	252.6	76.6
25	23.9	07.3	85	81.3	24.7	145	138.8	42.1	205	196.2	59.5	265	253.6	76.9
26	24.9	07.6	86	82.3	25.0	146	139.7	42.4	206	197.1	59.8	266	254.6	77.2
27	25.8	07.8	87	83.3	25.3	147	140.7	42.7	207	198.1	60.1	267	255.5	77.5
28	26.8	08.1	88	84.2	25.5	148	141.6	43.0	208	199.0	60.4	268	256.5	77.8
29	27.8	08.4	89	85.2	25.8	149	142.6	43.3	209	200.0	60.7	269	257.4	78.1
30	28.7	08.7	90	86.1	26.1	150	143.5	43.5	210	201.0	61.0	270	258.4	78.4
31	29.7	09.0	91	87.1	26.4	151	144.5	43.8	211	201.9	61.3	271	259.3	78.7
32	30.6	09.3	92	88.0	26.7	152	145.5	44.1	212	202.9	61.5	272	260.3	79.0
33	31.6	09.6	93	89.0	27.0	153	146.4	44.4	213	203.8	61.8	273	261.2	79.3
34	32.5	09.9	94	90.0	27.3	154	147.4	44.7	214	204.8	62.1	274	262.2	79.5
35	33.5	10.2	95	90.9	27.6	155	148.3	45.0	215	205.7	62.4	275	263.2	79.8
36	34.5	10.5	96	91.9	27.9	156	149.3	45.3	216	206.7	62.7	276	264.1	80.1
37	35.4	10.7	97	92.8	28.2	157	150.2	45.6	217	207.7	63.0	277	265.1	80.4
38	36.4	11.0	98	93.8	28.5	158	151.2	45.9	218	208.6	63.3	278	266.0	80.7
39	37.3	11.3	99	94.7	28.7	159	152.2	46.2	219	209.6	63.6	279	267.0	81.0
40	38.3	11.6	100	95.7	29.0	160	153.1	46.4	220	210.5	63.9	280	267.9	81.3
41	39.2	11.9	101	96.7	29.3	161	154.1	46.7	221	211.5	64.2	281	268.9	81.6
42	40.2	12.2	102	97.6	29.6	162	155.0	47.0	222	212.4	64.4	282	269.9	81.9
43	41.2	12.5	103	98.6	29.9	163	156.0	47.3	223	213.4	64.7	283	270.8	82.2
44	42.1	12.8	104	99.5	30.2	164	156.9	47.6	224	214.4	65.0	284	271.8	82.4
45	43.1	13.1	105	100.5	30.5	165	157.9	47.9	225	215.3	65.3	285	272.7	82.7
46	44.0	13.4	106	101.4	30.8	166	158.9	48.2	226	216.3	65.6	286	273.7	83.0
47	45.0	13.6	107	102.4	31.1	167	159.8	48.5	227	217.2	65.9	287	274.6	83.3
48	45.9	13.9	108	103.4	31.4	168	160.8	48.8	228	218.2	66.2	288	275.6	83.6
49	46.9	14.2	109	104.3	31.6	169	161.7	49.1	229	219.1	66.5	289	276.6	83.9
50	47.9	14.5	110	105.3	31.9	170	162.7	49.4	230	220.1	66.8	290	277.5	84.2
51	48.8	14.8	111	106.2	32.2	171	163.6	49.6	231	221.1	67.1	291	278.5	84.5
52	49.8	15.1	112	107.2	32.5	172	164.6	49.9	232	222.0	67.3	292	279.4	84.8
53	50.7	15.4	113	108.1	32.8	173	165.6	50.2	233	223.0	67.6	293	280.4	85.0
54	51.7	15.7	114	109.1	33.1	174	166.5	50.5	234	223.9	67.9	294	281.3	85.3
55	52.6	16.0	115	110.1	33.4	175	167.5	50.8	235	224.9	68.2	295	282.3	85.6
56	53.6	16.3	116	111.0	33.7	176	168.4	51.1	236	225.8	68.5	296	283.3	85.9
57	54.6	16.6	117	112.0	34.0	177	169.4	51.4	237	226.8	68.8	297	284.2	86.2
58	55.5	16.8	118	112.9	34.3	178	170.3	51.7	238	227.8	69.1	298	285.2	86.5
59	56.5	17.1	119	113.9	34.5	179	171.3	52.0	239	228.7	69.4	299	286.1	86.8
60	57.4	17.4	120	114.8	34.8	180	172.3	52.3	240	229.7	69.7	300	287.1	87.1
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 6½ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR $1\frac{3}{4}$ POINT.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.3	61	57.4	20.6	121	113.9	40.8	181	170.4	61.0	241	226.9	81.2
2	01 9	00.7	62	58.4	20.9	122	114.9	41.1	182	171.4	61.3	242	227.9	81.5
3	02.8	01.0	63	59.3	21.2	123	115.8	41.4	183	172.3	61.7	243	228.8	81.9
4	03.8	01.4	64	60.3	21.6	124	116.8	41.8	184	173.2	62.0	244	229.7	82 2
5	04.7	01.7	65	61.2	21.9	125	117.7	42.1	185	174.2	62.3	245	230.7	82.5
6	05.7	02.0	66	62.1	22.2	126	118.6	42.5	186	175.1	62.7	246	231.6	82.9
7	06.6	02.4	67	63.1	22.6	127	119.6	42.8	187	176.1	63.0	247	232.6	83.2
8	07.5	02.7	68	64.0	22.9	128	120.5	43.1	188	177.0	63.3	248	233.5	83.6
9	08.5	03 0	69	65.0	23.3	129	121.5	43.5	189	177.9	63.7	249	234.4	83.9
10	09.4	03.4	70	65.9	23.6	130	122.4	43.8	190	178.9	64.0	250	235.4	84.2
11	10.4	03.7	71	66.9	23.9	131	123.3	44.1	191	179.8	64.4	251	236.3	84.6
12	11.3	04.0	72	67.8	24.3	132	124.3	44.5	192	180.8	64.7	252	237.3	84.9
13	12 2	04.4	73	68.7	24.6	133	125.2	44.8	193	181.7	65.0	253	238.2	85.2
14	13.2	04.7	74	69.7	24.9	134	126.2	45.1	194	182 7	65.4	254	239.1	85.6
15	14.1	05.1	75	70.6	25.3	135	127.1	45.5	195	183.6	65.7	255	240.1	85.9
16	15.1	05.4	76	71.6	25.6	136	128.1	45.8	196	184.5	66.0	256	241.0	86.2
17	16.0	05.7	77	72.5	25.9	137	129.0	46.2	197	185.5	66.4	257	242.0	86.6
18	17.0	06.1	78	73.4	26.3	138	129.9	46.5	198	186.4	66.7	258	242.9	86.9
19	17.9	06.4	79	74 4	26.6	139	130.9	46.8	199	187.4	67.0	259	243.9	87.3
20	18.8	06.7	80	75.3	27 0	140	131.8	47.2	200	188.3	67.4	260	244.8	87.6
21	19.8	07.1	81	76.3	27.3	141	132.8	47.5	201	189.3	67.7	261	245.7	87.9
22	20.7	07.4	82	77.2	27.6	142	133.7	47.8	202	190.2	68.1	262	246.7	88.3
23	21.7	07.8	83	78.2	28.0	143	134.6	48.2	203	191.1	68.4	263	247.6	88.6
24	22.6	08.1	84	79.1	28.3	144	135.6	48.5	204	192.1	68.7	264	248.6	88.9
25	23.5	08.4	85	80.0	28.6	145	136.5	48.9	205	193.0	69.1	265	249.5	89.3
26	24.5	08.8	86	81.0	29.0	146	137.5	49.2	206	194.0	69.4	266	250.5	89.6
27	25.4	09.1	87	81.9	29.3	147	138.4	49.5	207	194.9	69.7	267	251.4	90.0
28	26.4	09.4	88	82.9	29.7	148	139.4	49.9	208	195.8	70.1	268	252.3	90.3
29	27.3	09.8	89	83.8	30.0	149	140.3	50.2	209	196.8	70.4	269	253.3	90.6
30	28.3	10.1	90	84.7	30.3	150	141.2	50.5	210	197.7	70.8	270	254.2	91.0
31	29.2	10.4	91	85.7	30.7	151	142.2	50.9	211	198.7	71.1	271	255.2	91.3
32	30.1	10.8	92	86.6	31.0	152	143.1	51.2	212	199.6	71.4	272	256.1	91.6
33	31.1	11.1	93	87.6	31.3	153	144.1	51.5	213	200.6	71.8	273	257.0	92.0
34	32.0	11.5	94	88.5	31.7	154	145.0	51.9	214	201.5	72.1	274	258.0	92.3
35	33.0	11.8	95	89.5	32.0	155	145.9	52.2	215	202.4	72.4	275	258.9	92.6
36	33.9	12.1	96	90.4	32.3	156	146.9	52.6	216	203.4	72.8	276	259.9	93.0
37	34.8	12.5	97	91.3	32.7	157	147.8	52.9	217	204.3	73.1	277	260.8	93.3
38	35.8	12.8	98	92.3	33.0	158	148.8	53.2	218	205.3	73.4	278	261.8	93.7
39	36.7	13.1	99	93.2	33.4	159	149.7	53.6	219	206.2	73.8	279	262.7	94.0
40	37.7	13.5	100	94.2	33.7	160	150.7	53.9	220	207.1	74.1	280	263.6	94.3
41	38.6	13.8	101	95.1	34.0	161	151.6	54.2	221	208.1	74.5	281	264.6	94.7
42	39.5	14.2	102	96.0	34.4	162	152.5	54.6	222	209.0	74.8	282	265.5	95.0
43	40.5	14.5	103	97.0	34.7	163	153.5	54.9	223	210.0	75.1	283	266.5	95.3
44	41.4	14.8	104	97.9	35.0	164	154 4	55.3	224	210.9	75.5	284	267.4	95.7
45	42.4	15.2	105	98.9	35.4	165	155.4	55.6	225	211.9	75.8	285	268.3	96.0
46	43.3	15.5	106	99.8	35.7	166	156 3	55.9	226	212.8	76.1	286	269.3	96.4
47	44.3	15.8	107	100.7	36.1	167	157.2	56.3	227	213.7	76.5	287	270.2	96.7
48	45.2	16.2	108	101.7	36.4	168	158.2	56.6	228	214.7	76.8	288	271.2	97.0
49	46.1	16.5	109	102.6	36.7	169	159.1	56.9	229	215.6	77.2	289	272.1	97 4
50	47.1	16.8	110	103.6	37.1	170	160.1	57.3	230	216.6	77.5	290	273.0	97.7
51	48.0	17.2	111	104.5	37.4	171	161.0	57.6	231	217.5	77.8	291	274.0	98.0
52	49.0	17.5	112	105.5	37.7	172	161.9	58.0	232	218.4	78.2	292	274 9	98.4
53	49.9	17.9	113	106.4	38.1	173	162.9	58.3	233	219.4	78.5	293	275.9	98.7
54	50.8	18.2	114	107.3	38.4	174	163.8	58.6	234	220.3	78.8	294	276.8	99.0
55	51.8	18.5	115	108.3	38.7	175	164.8	59.0	235	221.3	79.2	295	277.8	99.4
56	52.7	18.9	116	109.2	39.1	176	165.7	59.3	236	222.2	79.5	296	278 7	99.7
57	53.7	19.2	117	110.2	39.4	177	166.7	59.6	237	223.1	79.8	297	279.6	100 1
58	54.6	19.5	118	111.1	39.8	178	167.6	60.0	238	224.1	80.2	298	280.6	100 4
59	55.6	19.9	119	112.0	40.1	179	168.5	60.3	239	225.0	80.5	299	281.5	100 7
60	56.5	20.2	120	113.0	40.4	180	169.5	60.6	240	226.0	80.9	300	282.5	101.1
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For $6\frac{1}{4}$ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 2 POINTS.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.4	61	56.4	23.3	121	111.8	46.3	181	167.2	69.3	241	222.7	92.2
2	01.9	00.8	62	57.3	23.7	122	112.7	46.7	182	168.2	69.7	242	223.6	92.6
3	02.8	01.2	63	58.2	24.1	123	113.6	47.1	183	169.1	70.0	243	224.5	93.0
4	03.7	01.5	64	59.1	24.5	124	114.6	47.5	184	170.0	70.4	244	225.4	93.4
5	04.6	01.9	65	60.1	24.9	125	115.5	47.8	185	170.9	70.8	245	226.4	93.8
6	05.5	02.3	66	61.0	25.3	126	116.4	48.2	186	171.8	71.2	246	227.3	94.1
7	06.5	02.7	67	61.9	25.6	127	117.3	48.6	187	172.8	71.6	247	228.2	94.5
8	07.4	03.1	68	62.8	26.0	128	118.3	49.0	188	173.7	71.9	248	229.1	94.9
9	08.3	03.4	69	63.8	26.4	129	119.2	49.4	189	174.6	72.3	249	230.1	95.3
10	09.2	03.8	70	64.7	26.8	130	120.1	49.8	190	175.5	72.7	250	231.0	95.6
11	10.2	04.2	71	65.6	27.2	131	121.0	50.1	191	176.5	73.1	251	231.9	96.1
12	11.1	04.6	72	66.5	27.6	132	122.0	50.5	192	177.4	73.5	252	232.8	96.4
13	12.0	05.0	73	67.4	27.9	133	122.9	50.9	193	178.3	73.9	253	233.7	96.8
14	12.9	05.4	74	68.4	28.3	134	123.8	51.3	194	179.2	74.2	254	234.7	97.2
15	13.9	05.7	75	69.3	28.7	135	124.7	51.7	195	180.2	74.6	255	235.6	97.6
16	14.8	06.1	76	70.2	29.1	136	125.7	52.0	196	181.1	75.0	256	236.5	98.0
17	15.7	06.5	77	71.1	29.5	137	126.6	52.4	197	182.0	75.4	257	237.4	98.4
18	16.6	06.9	78	72.1	29.9	138	127.5	52.8	198	182.9	75.8	258	238.4	98.7
19	17.6	07.3	79	73.0	30.2	139	128.4	53.2	199	183.9	76.2	259	239.3	99.1
20	18.5	07.7	80	73.9	30.6	140	129.3	53.6	200	184.8	76.5	260	240.2	99.5
21	19.4	08.0	81	74.8	31.0	141	130.3	54.0	201	185.7	76.9	261	241.1	99.9
22	20.3	08.4	82	75.8	31.4	142	131.2	54.3	202	186.6	77.3	262	242.1	100.3
23	21.3	08.8	83	76.7	31.8	143	132.1	54.7	203	187.6	77.7	263	243.0	100.6
24	22.2	09.2	84	77.6	32.2	144	133.0	55.1	204	188.5	78.1	264	243.9	101.0
25	23.1	09.6	85	78.5	32.5	145	134.0	55.5	205	189.4	78.5	265	244.8	101.4
26	24.0	10.0	86	79.5	32.9	146	134.9	55.9	206	190.3	78.8	266	245.8	101.8
27	24.9	10.3	87	80.4	33.3	147	135.8	56.3	207	191.2	79.2	267	246.7	102.2
28	25.9	10.7	88	81.3	33.7	148	136.7	56.6	208	192.2	79.6	268	247.6	102.6
29	26.8	11.1	89	82.2	34.1	149	137.7	57.0	209	193.1	80.0	269	248.5	102.9
30	27.7	11.5	90	83.2	34.4	150	138.6	57.4	210	194.0	80.4	270	249.5	103.3
31	28.6	11.9	91	84.1	34.8	151	139.5	57.8	211	194.9	80.8	271	250.4	103.7
32	29.6	12.3	92	85.0	35.2	152	140.4	58.2	212	195.9	81.1	272	251.3	104.1
33	30.5	12.6	93	85.9	35.6	153	141.4	58.6	213	196.8	81.5	273	252.2	104.5
34	31.4	13.0	94	86.9	36.0	154	142.3	58.9	214	197.7	81.9	274	253.1	104.9
35	32.3	13.4	95	87.8	36.4	155	143.2	59.3	215	198.6	82.3	275	254.1	105.2
36	33.3	13.8	96	88.7	36.7	156	144.1	59.7	216	199.6	82.7	276	255.0	105.6
37	34.2	14.2	97	89.6	37.1	157	145.1	60.1	217	200.5	83.0	277	255.9	106.0
38	35.1	14.5	98	90.5	37.5	158	146.0	60.5	218	201.4	83.4	278	256.8	106.4
39	36.0	14.9	99	91.5	37.9	159	146.9	60.9	219	202.3	83.8	279	257.8	106.8
40	37.0	15.3	100	92.4	38.3	160	147.8	61.2	220	203.3	84.2	280	258.7	107.2
41	37.9	15.7	101	93.3	38.7	161	148.7	61.6	221	204.2	84.6	281	259.6	107.5
42	38.8	16.1	102	94.2	39.0	162	149.7	62.0	222	205.1	85.0	282	260.5	107.9
43	39.7	16.5	103	95.2	39.4	163	150.6	62.4	223	206.0	85.3	283	261.5	108.3
44	40.7	16.8	104	96.1	39.8	164	151.5	62.8	224	207.0	85.7	284	262.4	108.7
45	41.6	17.2	105	97.0	40.2	165	152.4	63.1	225	207.9	86.1	285	263.3	109.1
46	42.5	17.6	106	97.9	40.6	166	153.4	63.5	226	208.8	86.5	286	264.2	109.5
47	43.4	18.0	107	98.8	41.0	167	154.3	63.9	227	209.7	86.9	287	265.2	109.8
48	44.4	18.4	108	99.8	41.3	168	155.2	64.3	228	210.6	87.3	288	266.1	110.2
49	45.3	18.8	109	100.7	41.7	169	156.1	64.7	229	211.6	87.6	289	267.0	110.6
50	46.2	19.1	110	101.6	42.1	170	157.1	65.1	230	212.5	88.0	290	267.9	111.0
51	47.1	19.5	111	102.6	42.5	171	158.0	65.4	231	213.4	88.4	291	268.9	111.4
52	48.0	19.9	112	103.5	42.9	172	158.9	65.8	232	214.3	88.8	292	269.8	111.7
53	49.0	20.3	113	104.4	43.2	173	159.8	66.2	233	215.3	89.2	293	270.7	112.1
54	49.9	20.7	114	105.3	43.6	174	160.8	66.6	234	216.2	89.6	294	271.6	112.5
55	50.8	21.1	115	106.3	44.0	175	161.7	67.0	235	217.1	89.9	295	272.5	112.9
56	51.7	21.4	116	107.2	44.4	176	162.6	67.4	236	218.0	90.3	296	273.5	113.3
57	52.7	21.8	117	108.1	44.8	177	163.5	67.7	237	219.0	90.7	297	274.4	113.7
58	53.6	22.2	118	109.0	45.2	178	164.5	68.1	238	219.9	91.1	298	275.3	114.0
59	54.5	22.6	119	109.9	45.5	179	165.4	68.5	239	220.8	91.5	299	276.2	114.4
60	55.4	23.0	120	110.9	45.9	180	166.3	68.9	240	221.7	91.8	300	277.2	114.8
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 6 Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 2¼ POINT.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.4	61	55.1	26.1	121	109.4	51.7	181	163.6	77.4	241	217.9	103.0
2	01.8	00.9	62	56.0	26.5	122	110.3	52.2	182	164.5	77.8	242	218.8	103.5
3	02.7	01.3	63	57.0	26.9	123	111.2	52.6	183	165.4	78.3	243	219.7	103.9
4	03.6	01.7	64	57.9	27.4	124	112.1	53.0	184	166.3	78.7	244	220.6	104.3
5	04.5	02.1	65	58.8	27.8	125	113.0	53.5	185	167.2	79.1	245	221.5	104.8
6	05.4	02.6	66	59.7	28.2	126	113.9	53.9	186	168.1	79.5	246	222.4	105.2
7	06.3	03.0	67	60.6	28.7	127	114.8	54.3	187	169.0	80.0	247	223.3	105.6
8	07.2	03.4	68	61.5	29.1	128	115.7	54.7	188	169.9	80.4	248	224.2	106.1
9	08.1	03.8	69	62.4	29.5	129	116.6	55.2	189	170.9	80.8	249	225.1	106.5
10	09.0	04.3	70	63.3	29.9	130	117.5	55.6	190	171.8	81.3	250	226.0	106.9
11	09.9	04.7	71	64.2	30.4	131	118.4	56.0	191	172.7	81.7	251	226.9	107.3
12	10.8	05.1	72	65.1	30.8	132	119.3	56.5	192	173.6	82.1	252	227.8	107.8
13	11.8	05.6	73	66.0	31.2	133	120.2	56.9	193	174.5	82.5	253	228.7	108.2
14	12 7	06.0	74	66.9	31.6	134	121.1	57.3	194	175.4	83.0	254	229.6	108.6
15	13.6	06.4	75	67.8	32.1	135	122.0	57.7	195	176.3	83.4	255	230.5	109.0
16	14.5	06.8	76	68.7	32.5	136	122.9	58.2	196	177.2	83.8	256	231.4	109.5
17	15.4	07.3	77	69.6	32.9	137	123.8	58.6	197	178.1	84.2	257	232.3	109.9
18	16.3	07.7	78	70.5	33.4	138	124.7	59.0	198	179.0	84.7	258	233.2	110.3
19	17.2	08.1	79	71.4	33.8	139	125.7	59.4	199	179.9	85.1	259	234.1	110.8
20	18.1	08.6	80	72.3	34.2	140	126.6	59.9	200	180.8	85.5	260	235.0	111.2
21	19.0	09.0	81	73.2	34.6	141	127.5	60.3	201	181.7	85.9	261	235.9	111.6
22	19.9	09.4	82	74.1	35.1	142	128.4	60 7	202	182.6	86.4	262	236.8	112.0
23	20.8	09.8	83	75.0	35.5	143	129.3	61.2	203	183.5	86.8	263	237.7	112.5
24	21.7	10.3	84	75.9	35.9	144	130.2	61.6	204	184.4	87.2	264	238.7	112.9
25	22.6	10.7	85	76.8	36.3	145	131.1	62.0	205	185.3	87.7	265	239.6	113.3
26	23.5	11.1	86	77.7	36.8	146	132.0	62.4	206	186.2	88.1	266	240.5	113.7
27	24.4	11.5	87	78.7	37.2	147	132.9	62.9	207	187.1	88.5	267	241.4	114 2
28	25.3	12.0	88	79.6	37.6	148	133.8	63.3	208	188.0	88.9	268	242.3	114.6
29	26.2	12.4	89	80.5	38.1	149	134.7	63.7	209	188.9	89.4	269	243.2	115.0
30	27.1	12.8	90	81.4	38.5	150	135.6	64.1	210	189.8	89.8	270	244.1	115.5
31	28.0	13.3	91	82.3	38.9	151	136.5	64.6	211	190.7	90.2	271	245.0	115.9
32	28.9	13.7	92	83.2	39.3	152	137.4	65.0	212	191.6	90.7	272	245.9	116.3
33	29.8	14.1	93	84.1	39.8	153	138.3	65.4	213	192.6	91.1	273	246.8	116.7
34	30.7	14.5	94	85.0	40.2	154	139.2	65.9	214	193.5	91.5	274	247.7	117.2
35	31.6	15.0	95	85.9	40.6	155	140.1	66.3	215	194.4	91.9	275	248.6	117.6
36	32.5	15.4	96	86.8	41.1	156	141.0	66.7	216	195.3	92.4	276	249.5	118.0
37	33.4	15.8	97	87.7	41.5	157	141.9	67.1	217	196.2	92.8	277	250.4	118.5
38	34.4	16.3	98	88.6	41.9	158	142.8	67.6	218	197.1	93.2	278	251.3	118.9
39	35.3	16.7	99	89.5	42.3	159	143.7	68.0	219	198.0	93.7	279	252 2	119.3
40	36.2	17.1	100	90.4	42.8	160	144.6	68.4	220	198.9	94.1	280	253.1	119.7
41	37.1	17.5	101	91.3	43.2	161	145.5	68.8	221	199.8	94.5	281	254.0	120.2
42	38.0	18.0	102	92.2	43.6	162	146.4	69.3	222	200.7	94.9	282	254.9	120.6
43	38.9	18.4	103	93.1	44.1	163	147.3	69.7	223	201.6	95.4	283	255.8	121.0
44	39.8	18.8	104	94.0	44.5	164	148.3	70.1	224	202.5	95.8	284	256.7	121.5
45	40.7	19.2	105	94.9	44.9	165	149.2	70.6	225	203.4	96.2	285	257.6	121.9
46	41.6	19.7	106	95.8	45.3	166	150.1	71.0	226	204.3	96.6	286	258.5	122.3
47	42.5	20.1	107	96.7	45.8	167	151.0	71.4	227	205.2	97.1	287	259.4	122.7
48	43.4	20.5	108	97.6	46.2	168	151.9	71.8	228	206.1	97.5	288	260.3	123.2
49	44.3	21.0	109	98.5	46.6	169	152.8	72.3	229	207.0	97.9	289	261.3	123.6
50	45.2	21.4	110	99.4	47.0	170	153.7	72.7	230	207.9	98.4	290	262.2	124.0
51	46.1	21.8	111	100.3	47.5	171	154.6	73.1	231	208.8	98.8	291	263.1	124.4
52	47.0	22.2	112	101.2	47.9	172	155.5	73.6	232	209.7	99.2	292	264.0	124.9
53	47.9	22.7	113	102.2	48.3	173	156.4	74.0	233	210.6	99.6	293	264.9	125.3
54	48.8	23.1	114	103.1	48.7	174	157.3	74.4	234	211.5	100.1	294	265.8	125.7
55	49.7	23.5	115	104.0	49.2	175	158.2	74.8	235	212.4	100.5	295	266.7	126.2
56	50.6	23.9	116	104.9	49.6	176	159.1	75.3	236	213.3	100.9	296	267.6	126.6
57	51.5	24.4	117	105.8	50.0	177	160.0	75.7	237	214.2	101.4	297	268.5	127.0
58	52.4	24.8	118	106.7	50 5	178	160.9	76.1	238	215.1	101.8	298	269.4	127.4
59	53.3	25.2	119	107.6	50.9	179	161.8	76.5	239	216.1	102.2	299	270.3	127.9
60	54.2	25.7	120	108.5	51.3	180	162.7	77.0	240	217.0	102.6	300	271.2	128.3
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 5¾ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 2½ POINT.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.5	61	53.8	28.8	121	106.7	57.0	181	159.6	85.3	241	212.5	113.6
2	01.8	00.9	62	54.7	29.2	122	107.6	57.5	182	160.5	85.8	242	213.4	114.1
3	02.6	01.4	63	55.6	29.7	123	108.5	58.0	183	161.4	86.3	243	214.3	114.6
4	03.5	01.9	64	56.4	30.2	124	109.4	58.4	184	162.3	86.7	244	215.2	115.0
5	04.4	02.4	65	57.3	30.6	125	110.2	58.9	185	163.2	87.2	245	216.1	115.5
6	05.3	02.8	66	58.2	31.1	126	111.1	59.4	186	164.0	87.7	246	217.0	116.0
7	06.2	03.3	67	59.1	31.6	127	112.0	59.9	187	164.9	88.1	247	217.8	116.4
8	07.1	03.8	68	60.0	32.1	128	112.9	60.3	188	165.8	88.6	248	218.7	116.9
9	07.9	04.2	69	60.9	32.5	129	113.8	60.8	189	166.7	89.1	249	219.6	117.4
10	08.8	04.7	70	61.7	33.0	130	114.7	61.3	190	167.6	89.6	250	220.5	117.8
11	09.7	05.2	71	62.6	33.5	131	115.5	61.7	191	168.5	90.0	251	221.4	118.3
12	10.6	05.7	72	63.5	33.9	132	116.4	62.2	192	169.3	90.5	252	222.2	118.8
13	11.5	06.1	73	64.4	34.4	133	117.3	62.7	193	170.2	91.0	253	223.1	119.3
14	12.3	06.6	74	65.3	34.9	134	118.2	63.2	194	171.1	91.4	254	224.0	119.7
15	13.2	07.1	75	66.1	35.4	135	119.1	63.6	195	172.0	91.9	255	224.9	120.2
16	14.1	07.5	76	67.0	35.8	136	119.9	64.1	196	172.9	92.4	256	225.8	120.7
17	15.0	08.0	77	67.9	36.3	137	120.8	64.6	197	173.7	92.9	257	226.7	121.1
18	15.9	08.5	78	68.8	36.8	138	121.7	65.0	198	174.6	93.3	258	227.5	121.6
19	16.8	09.0	79	69.7	37.2	139	122.6	65.5	199	175.5	93.8	259	228.4	122.1
20	17.6	09.4	80	70.6	37.7	140	123.5	66.0	200	176.4	94.3	260	229.3	122.6
21	18.5	09.9	81	71.4	38.2	141	124.4	66.5	201	177.3	94.7	261	230.2	123.0
22	19.4	10.4	82	72.3	38.6	142	125.2	66.9	202	178.2	95.2	262	231.1	123.5
23	20.3	10.8	83	73.2	39.1	143	126.1	67.4	203	179.0	95.7	263	231.9	124.0
24	21.2	11.3	84	74.1	39.6	144	127.0	67.9	204	179.9	96.2	264	232.8	124.4
25	22.1	11.8	85	75.0	40.1	145	127.9	68.3	205	180.8	96.6	265	233.7	124.9
26	22.9	12.3	86	75.9	40.5	146	128.8	68.8	206	181.7	97.1	266	234.6	125.4
27	23.8	12.7	87	76.7	41.0	147	129.6	69.3	207	182.6	97.6	267	235.5	125.9
28	24.7	13.2	88	77.6	41.5	148	130.5	69.8	208	183.4	98.0	268	236.4	126.3
29	25.6	13.7	89	78.5	41.9	149	131.4	70.2	209	184.3	98.5	269	237.2	126.8
30	26.5	14.1	90	79.4	42.4	150	132.3	70.7	210	185.2	99.0	270	238.1	127.3
31	27.3	14.6	91	80.3	42.9	151	133.2	71.2	211	186.1	99.5	271	239.0	127.7
32	28.2	15.1	92	81.1	43.4	152	134.1	71.6	212	187.0	99.9	272	239.9	128.2
33	29.1	15.6	93	82.0	43.8	153	134.9	72.1	213	187.8	100.4	273	240.8	128.7
34	30.0	16.0	94	82.9	44.3	154	135.8	72.6	214	188.7	100.9	274	241.7	129.2
35	30.9	16.5	95	83.8	44.8	155	136.7	73.1	215	189.6	101.3	275	242.5	129.6
36	31.8	17.0	96	84.7	45.2	156	137.6	73.5	216	190.5	101.8	276	243.4	130.1
37	32.6	17.4	97	85.6	45.7	157	138.5	74.0	217	191.4	102.3	277	244.3	130.6
38	33.5	17.9	98	86.4	46.2	158	139.3	74.5	218	192.3	102.8	278	245.2	131.0
39	34.4	18.4	99	87.3	46.7	159	140.2	74.9	219	193.1	103.2	279	246.1	131.5
40	35.3	18.9	100	88.2	47.1	160	141.1	75.4	220	194.0	103.7	280	246.9	132.0
41	36.2	19.3	101	89.1	47.6	161	142.0	75.9	221	194.9	104.2	281	247.8	132.5
42	37.0	19.8	102	90.0	48.1	162	142.9	76.4	222	195.8	104.6	282	248.7	132.9
43	37.9	20.3	103	90.8	48.5	163	143.8	76.8	223	196.7	105.1	283	249.6	133.4
44	38.8	20.7	104	91.7	49.0	164	144.6	77.3	224	197.6	105.6	284	250.5	133.9
45	39.7	21.2	105	92.6	49.5	165	145.5	77.8	225	198.4	106.1	285	251.4	134.3
46	40.6	21.7	106	93.5	50.0	166	146.4	78.2	226	199.3	106.5	286	252.2	134.8
47	41.5	22.2	107	94.4	50.4	167	147.3	78.7	227	200.2	107.0	287	253.1	135.3
48	42.3	22.6	108	95.3	50.9	168	148.2	79.2	228	201.1	107.5	288	254.0	135.8
49	43.2	23.1	109	96.1	51.4	169	149.0	79.7	229	202.0	107.9	289	254.9	136.2
50	44.1	23.6	110	97.0	51.8	170	149.9	80.1	230	202.8	108.4	290	255.8	136.7
51	45.0	24.0	111	97.9	52.3	171	150.8	80.6	231	203.7	108.9	291	256.6	137.2
52	45.9	24.5	112	98.8	52.8	172	151.7	81.1	232	204.6	109.4	292	257.5	137.6
53	46.7	25.0	113	99.7	53.3	173	152.6	81.5	233	205.5	109.8	293	258.4	138.1
54	47.6	25.5	114	100.5	53.7	174	153.5	82.0	234	206.4	110.3	294	259.3	138.6
55	48.5	25.9	115	101.4	54.2	175	154.3	82.5	235	207.3	110.8	295	260.2	139.1
56	49.4	26.4	116	102.3	54.7	176	155.2	83.0	236	208.1	111.2	296	261.1	139.5
57	50.3	26.9	117	103.2	55.1	177	156.1	83.4	237	209.0	111.7	297	261.9	140.0
58	51.2	27.3	118	104.1	55.6	178	157.0	83.9	238	209.9	112.2	298	262.8	140.5
59	52.0	27.8	119	105.0	56.1	179	157.9	84.4	239	210.8	112.7	299	263.7	140.9
60	52.9	28.3	120	105.8	56.6	180	158.8	84.8	240	211.7	113.1	300	264.6	141.4
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 5½ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 2¾ POINT.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.5	61	52.3	31.4	121	103.8	62.2	181	155.3	93.0	241	206.7	123.9
2	01.7	01.0	62	53.2	31.9	122	104.6	62.7	182	156.1	93.6	242	207.6	124.4
3	02.6	01.5	63	54.0	32.4	123	105.5	63.2	183	157.0	94.1	243	208.4	124.9
4	03.4	02.1	64	54.9	32.9	124	106.4	63.7	184	157.8	94.6	244	209.3	125.4
5	04.3	02.6	65	55.8	33.4	125	107.2	64.3	185	158.7	95.1	245	210.1	125.9
6	05.1	03.1	66	56.6	33.9	126	108.1	64.8	186	159.5	95.6	246	211.0	126.5
7	06.0	03.6	67	57.5	34.4	127	108.9	65.3	187	160.4	96.1	247	211.9	127.0
8	06.9	04.1	68	58.3	35.0	128	109.8	65.8	188	161.2	96.6	248	212.7	127.5
9	07.7	04.6	69	59.2	35.5	129	110.6	66.3	189	162.1	97.2	249	213.6	128.0
10	08.6	05.1	70	60.0	36.0	130	111.5	66.8	190	163.0	97.7	250	214.4	128.5
11	09.4	05.7	71	60.9	36.5	131	112.4	67.3	191	163.8	98.2	251	215.3	129.0
12	10.3	06.2	72	61.8	37.0	132	113.2	67.9	192	164.7	98.7	252	216.1	129.5
13	11.2	06.7	73	62.6	37.5	133	114.1	68.4	193	165.5	99.2	253	217.0	130.1
14	12.0	07.2	74	63.5	38.0	134	114.9	68.9	194	166.4	99.7	254	217.9	130.6
15	12.9	07.7	75	64.3	38.6	135	115.8	69.4	195	167.3	100.2	255	218.7	131.1
16	13.7	08.2	76	65.2	39.1	136	116.6	69.9	196	168.1	100.8	256	219.6	131.6
17	14.6	08.7	77	66.0	39.6	137	117.5	70.4	197	169.0	101.3	257	220.4	132.1
18	15.4	09.3	78	66.9	40.1	138	118.4	70.9	198	169.8	101.8	258	221.3	132.6
19	16.3	09.8	79	67.8	40.6	139	119.2	71.5	199	170.7	102.3	259	222.2	133.1
20	17.2	10.3	80	68.6	41.1	140	120.1	72.0	200	171.5	102.8	260	223.0	133.7
21	18.0	10.8	81	69.5	41.6	141	120.9	72.5	201	172.4	103.3	261	223.9	134.2
22	18.9	11.3	82	70.3	42.1	142	121.8	73.0	202	173.3	103.8	262	224.7	134.7
23	19.7	11.8	83	71.2	42.7	143	122.7	73.5	203	174.1	104.4	263	225.6	135.2
24	20.6	12.3	84	72.0	43.2	144	123.5	74.0	204	175.0	104.9	264	226.4	135.7
25	21.4	12.9	85	72.9	43.7	145	124.4	74.5	205	175.8	105.4	265	227.3	136.2
26	22.3	13.4	86	73.8	44.2	146	125.2	75.1	206	176.7	105.9	266	228.2	136.7
27	23.2	13.9	87	74.6	44.7	147	126.1	75.6	207	177.5	106.4	267	229.0	137.3
28	24.0	14.4	88	75.5	45.2	148	126.9	76.1	208	178.4	106.9	268	229.9	137.8
29	24.9	14.9	89	76.3	45.7	149	127.8	76.6	209	179.3	107.4	269	230.7	138.3
30	25.7	15.4	90	77.2	46.3	150	128.7	77.1	210	180.1	108.0	270	231.6	138.8
31	26.6	15.9	91	78.1	46.8	151	129.5	77.6	211	181.0	108.5	271	232.4	139.3
32	27.4	16.5	92	78.9	47.3	152	130.4	78.1	212	181.8	109.0	272	233.3	139.8
33	28.3	17.0	93	79.8	47.8	153	131.2	78.7	213	182.7	109.5	273	234.2	140.3
34	29.2	17.5	94	80.6	48.3	154	132.1	79.2	214	183.5	110.0	274	235.0	140.9
35	30.0	18.0	95	81.5	48.8	155	132.9	79.7	215	184.4	110.5	275	235.9	141.4
36	30.9	18.5	96	82.3	49.3	156	133.8	80.2	216	185.3	111.0	276	236.7	141.9
37	31.7	19.0	97	83.2	49.9	157	134.7	80.7	217	186.1	111.6	277	237.6	142.4
38	32.6	19.5	98	84.1	50.4	158	135.5	81.2	218	187.0	112.1	278	238.4	142.9
39	33.5	20.1	99	84.9	50.9	159	136.4	81.7	219	187.8	112.6	279	239.3	143.4
40	34.3	20.6	100	85.8	51.4	160	137.2	82.3	220	188.7	113.1	280	240.2	143.9
41	35.2	21.1	101	86.6	51.9	161	138.1	82.8	221	189.6	113.6	281	241.0	144.5
42	36.0	21.6	102	87.5	52.4	162	138.9	83.3	222	190.4	114.1	282	241.9	145.0
43	36.9	22.1	103	88.3	52.9	163	139.8	83.8	223	191.3	114.6	283	242.7	145.5
44	37.7	22.6	104	89.2	53.5	164	140.7	84.3	224	192.1	115.2	284	243.6	146.0
45	38.6	23.1	105	90.1	54.0	165	141.5	84.8	225	193.0	115.7	285	244.4	146.5
46	39.5	23.6	106	90.9	54.5	166	142.4	85.3	226	193.8	116.2	286	245.3	147.0
47	40.3	24.2	107	91.8	55.0	167	143.2	85.8	227	194.7	116.7	287	246.2	147.5
48	41.2	24.7	108	92.6	55.5	168	144.1	86.4	228	195.6	117.2	288	247.0	148.1
49	42.0	25.2	109	93.5	56.0	169	145.0	86.9	229	196.4	117.7	289	247.9	148.6
50	42.9	25.7	110	94.3	56.5	170	145.8	87.4	230	197.3	118.2	290	248.7	149.1
51	43.7	26.2	111	95.2	57.1	171	146.7	87.9	231	198.1	118.8	291	249.6	149.6
52	44.6	26.7	112	96.1	57.6	172	147.5	88.4	232	199.0	119.3	292	250.5	150.1
53	45.5	27.2	113	96.9	58.1	173	148.4	88.9	233	199.8	119.8	293	251.3	150.6
54	46.3	27.8	114	97.8	58.6	174	149.2	89.4	234	200.7	120.3	294	252.2	151.1
55	47.2	28.3	115	98.6	59.1	175	150.1	90.0	235	201.6	120.8	295	253.0	151.7
56	48.0	28.8	116	99.5	59.6	176	151.0	90.5	236	202.4	121.3	296	253.9	152.2
57	48.9	29.3	117	100.4	60.1	177	151.8	91.0	237	203.3	121.8	297	254.7	152.7
58	49.7	29.8	118	101.2	60.7	178	152.7	91.5	238	204.1	122.4	298	255.6	153.2
59	50.6	30.3	119	102.1	61.2	179	153.5	92.0	239	205.0	122.9	299	256.5	153.7
60	51.5	30.8	120	102.9	61.7	180	154.4	92.5	240	205.9	123.4	300	257.3	154.2
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 5¼ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 3 POINTS.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.6	61	50.7	33.9	121	100.6	67.2	181	150.5	100.6	241	200.4	133.9
2	01.7	01.1	62	51.5	34.4	122	101.4	67.8	182	151.3	101.1	242	201.2	134.4
3	02.5	01.7	63	52.4	35.0	123	102.3	68.3	183	152.2	101.7	243	202.0	135.0
4	03.3	02.2	64	53.2	35.6	124	103.1	68.9	184	153.0	102.2	244	202.9	135.6
5	04.2	02.8	65	54.0	36.1	125	103.9	69.4	185	153.8	102.8	245	203.7	136.1
6	05.0	03.3	66	54.9	36.7	126	104.8	70.0	186	154.6	103.3	246	204.5	136.7
7	05.8	03.9	67	55.7	37.2	127	105.6	70.6	187	155.5	103.9	247	205.4	137.2
8	06.7	04.4	68	56.5	37.8	128	106.4	71.1	188	156.3	104.4	248	206.2	137.8
9	07.5	05.0	69	57.4	38.3	129	107.3	71.7	189	157.1	105.0	249	207.0	138.3
10	08.3	05.6	70	58.2	38.9	130	108.1	72.2	190	158.0	105.6	250	207.9	138.9
11	09.1	06.1	71	59.0	39.4	131	108.9	72.8	191	158.8	106.1	251	208.7	139.4
12	10.0	06.7	72	59.9	40.0	132	109.7	73.3	192	159.6	106.7	252	209.5	140.0
13	10.8	07.2	73	60.7	40.6	133	110.6	73.9	193	160.5	107.2	253	210.4	140.6
14	11.6	07.8	74	61.5	41.1	134	111.4	74.4	194	161.3	107.8	254	211.2	141.1
15	12.5	08.3	75	62.4	41.7	135	112.2	75.0	195	162.1	108.3	255	212.0	141.7
16	13.3	08.9	76	63.2	42.2	136	113.1	75.6	196	163.0	108.9	256	212.9	142.2
17	14.1	09.4	77	64.0	42.8	137	113.9	76.1	197	163.8	109.4	257	213.7	142.8
18	15.0	10.0	78	64.8	43.3	138	114.7	76.7	198	164.6	110.0	258	214.5	143.3
19	15.8	10.6	79	65.7	43.9	139	115.6	77.2	199	165.5	110.6	259	215.3	143.9
20	16.6	11.1	80	66.5	44.4	140	116.4	77.8	200	166.3	111.1	260	216.2	144.4
21	17.5	11.7	81	67.3	45.0	141	117.2	78.3	201	167.1	111.7	261	217.0	145.0
22	18.3	12.2	82	68.2	45.6	142	118.1	78.9	202	168.0	112.2	262	217.8	145.6
23	19.1	12.8	83	69.0	46.1	143	118.9	79.4	203	168.8	112.8	263	218.7	146.1
24	20.0	13.3	84	69.8	46.7	144	119.7	80.0	204	169.6	113.3	264	219.5	146.7
25	20.8	13.9	85	70.7	47.2	145	120.6	80.6	205	170.4	113.9	265	220.3	147.2
26	21.6	14.4	86	71.5	47.8	146	121.4	81.1	206	171.3	114.4	266	221.2	147.8
27	22.4	15.0	87	72.3	48.3	147	122.2	81.7	207	172.1	115.0	267	222.0	148.3
28	23.3	15.6	88	73.2	48.9	148	123.1	82.2	208	172.9	115.6	268	222.8	148.9
29	24.1	16.1	89	74.0	49.4	149	123.9	82.8	209	173.8	116.1	269	223.7	149.4
30	24.9	16.7	90	74.8	50.0	150	124.7	83.3	210	174.6	116.7	270	224.5	150.0
31	25.8	17.2	91	75.7	50.6	151	125.5	83.9	211	175.4	117.2	271	225.3	150.6
32	26.6	17.8	92	76.5	51.1	152	126.4	84.4	212	176.3	117.8	272	226.2	151.1
33	27.4	18.3	93	77.3	51.7	153	127.2	85.0	213	177.1	118.3	273	227.0	151.7
34	28.3	18.9	94	78.2	52.2	154	128.0	85.6	214	177.9	118.9	274	227.8	152.2
35	29.1	19.4	95	79.0	52.8	155	128.9	86.1	215	178.8	119.4	275	228.6	152.8
36	29.9	20.0	96	79.8	53.3	156	129.7	86.7	216	179.6	120.0	276	229.5	153.3
37	30.8	20.6	97	80.6	53.9	157	130.5	87.2	217	180.4	120.6	277	230.3	153.9
38	31.6	21.1	98	81.5	54.4	158	131.4	87.8	218	181.3	121.1	278	231.1	154.4
39	32.4	21.7	99	82.3	55.0	159	132.2	88.3	219	182.1	121.7	279	232.0	155.0
40	33.3	22.2	100	83.1	55.6	160	133.0	88.9	220	182.9	122.2	280	232.8	155.6
41	34.1	22.8	101	84.0	56.1	161	133.9	89.4	221	183.7	122.8	281	233.6	156.1
42	34.9	23.3	102	84.8	56.7	162	134.7	90.0	222	184.6	123.3	282	234.5	156.7
43	35.8	23.9	103	85.6	57.2	163	135.5	90.6	223	185.4	123.9	283	235.3	157.2
44	36.6	24.4	104	86.5	57.8	164	136.4	91.1	224	186.2	124.4	284	236.1	157.8
45	37.4	25.0	105	87.3	58.3	165	137.2	91.7	225	187.1	125.0	285	237.0	158.3
46	38.2	25.6	106	88.1	58.9	166	138.0	92.2	226	187.9	125.6	286	237.8	158.9
47	39.1	26.1	107	89.0	59.4	167	138.9	92.8	227	188.7	126.1	287	238.6	159.4
48	39.9	26.7	108	89.8	60.0	168	139.7	93.3	228	189.6	126.7	288	239.5	160.0
49	40.7	27.2	109	90.6	60.6	169	140.5	93.9	229	190.4	127.2	289	240.3	160.6
50	41.6	27.8	110	91.5	61.1	170	141.3	94.4	230	191.2	127.8	290	241.1	161.1
51	42.4	28.3	111	92.3	61.7	171	142.2	95.0	231	192.1	128.3	291	242.0	161.7
52	43.2	28.9	112	93.1	62.2	172	143.0	95.6	232	192.9	128.9	292	242.8	162.2
53	44.1	29.4	113	94.0	62.8	173	143.8	96.1	233	193.7	129.4	293	243.6	162.8
54	44.9	30.0	114	94.8	63.3	174	144.7	96.7	234	194.6	130.0	294	244.4	163.3
55	45.7	30.6	115	95.6	63.9	175	145.5	97.2	235	195.4	130.6	295	245.3	163.9
56	46.6	31.1	116	96.4	64.4	176	146.3	97.8	236	196.2	131.1	296	246.1	164.4
57	47.4	31.7	117	97.3	65.0	177	147.2	98.3	237	197.1	131.7	297	246.9	165.0
58	48.2	32.2	118	98.1	65.6	178	148.0	98.9	238	197.9	132.2	298	247.8	165.6
59	49.1	32.8	119	98.9	66.1	179	148.8	99.4	239	198.7	132.8	299	248.6	166.1
60	49.9	33.3	120	99.8	66.7	180	149.7	100.0	240	199.5	133.3	300	249.4	166.7
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 5 Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 3¼ POINT.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.6	61	49.0	36.3	121	97.2	72.1	181	145.4	107.8	241	193.6	143.6
2	01.6	01.2	62	49.8	36.9	122	98.0	72.7	182	146.2	108.4	242	194.4	144.2
3	02.4	01.8	63	50.6	37.5	123	98.8	73.3	183	147.0	109.0	243	195.2	144.8
4	03.2	02.4	64	51.4	38.1	124	99.6	73.9	184	147.8	109.6	244	196.0	145.4
5	04.0	03.0	65	52.2	38.7	125	100.4	74.5	185	148.6	110.2	245	196.8	146.0
6	04.8	03.6	66	53.0	39.3	126	101.2	75.1	186	149.4	110.8	246	197.6	146.5
7	05.6	04.2	67	53.8	39.9	127	102.0	75.7	187	150.2	111.4	247	198.4	147.1
8	06.4	04.8	68	54.6	40.5	128	102.8	76.3	188	151.0	112.0	248	199.2	147.7
9	07.2	05.4	69	55.4	41.1	129	103.6	76.9	189	151.8	112.6	249	200.0	148.3
10	08.0	06.0	70	56.2	41.7	130	104.4	77.4	190	152.6	113.2	250	200.8	148.9
11	08.8	06.6	71	57.0	42.3	131	105.2	78.0	191	153.4	113.8	251	201.6	149.5
12	09.6	07.1	72	57.8	42.9	132	106.0	78.6	192	154.2	114.4	252	202.4	150.1
13	10.4	07.7	73	58.6	43.5	133	106.8	79.2	193	155.0	115.0	253	203.2	150.7
14	11.2	08.3	74	59.4	44.1	134	107.6	79.8	194	155.8	115.6	254	204.0	151.3
15	12.0	08.9	75	60.2	44.7	135	108.4	80.4	195	156.6	116.2	255	204.8	151.9
16	12.9	09.5	76	61.0	45.3	136	109.2	81.0	196	157.4	116.8	256	205.6	152.5
17	13.7	10.1	77	61.8	45.9	137	110.0	81.6	197	158.2	117.4	257	206.4	153.1
18	14.5	10.7	78	62.6	46.5	138	110.8	82.2	198	159.0	118.0	258	207.2	153.7
19	15.3	11.3	79	63.4	47.1	139	111.6	82.8	199	159.8	118.5	259	208.0	154.3
20	16.1	11.9	80	64.3	47.7	140	112.4	83.4	200	160.6	119.1	260	208.8	154.9
21	16.9	12.5	81	65.1	48.3	141	113.2	84.0	201	161.4	119.7	261	209.6	155.5
22	17.7	13.1	82	65.9	48.9	142	114.0	84.6	202	162.2	120.3	262	210.4	156.1
23	18.5	13.7	83	66.7	49.4	143	114.9	85.2	203	163.0	120.9	263	211.2	156.7
24	19.3	14.3	84	67.5	50.0	144	115.7	85.8	204	163.9	121.5	264	212.0	157.3
25	20.1	14.9	85	68.3	50.6	145	116.5	86.4	205	164.7	122.1	265	212.8	157.9
26	20.9	15.5	86	69.1	51.2	146	117.3	87.0	206	165.5	122.7	266	213.6	158.5
27	21.7	16.1	87	69.9	51.8	147	118.1	87.6	207	166.3	123.3	267	214.5	159.1
28	22.5	16.7	88	70.7	52.4	148	118.9	88.2	208	167.1	123.9	268	215.3	159.6
29	23.3	17.3	89	71.5	53.0	149	119.7	88.7	209	167.9	124.5	269	216.1	160.2
30	24.1	17.9	90	72.3	53.6	150	120.5	89.4	210	168.7	125.1	270	216.9	160.8
31	24.9	18.5	91	73.1	54.2	151	121.3	90.0	211	169.5	125.7	271	217.7	161.4
32	25.7	19.1	92	73.9	54.8	152	122.1	90.5	212	170.3	126.3	272	218.5	162.0
33	26.5	19.7	93	74.7	55.4	153	122.9	91.1	213	171.1	126.9	273	219.3	162.6
34	27.3	20.3	94	75.5	56.0	154	123.7	91.7	214	171.9	127.5	274	220.1	163.2
35	28.1	20.9	95	76.3	56.6	155	124.5	92.3	215	172.7	128.1	275	220.9	163.8
36	28.9	21.4	96	77.1	57.2	156	125.3	92.9	216	173.5	128.7	276	221.7	164.4
37	29.7	22.0	97	77.9	57.8	157	126.1	93.5	217	174.3	129.3	277	222.5	165.0
38	30.5	22.6	98	78.7	58.4	158	126.9	94.1	218	175.1	129.9	278	223.3	165.6
39	31.3	23.2	99	79.5	59.0	159	127.7	94.7	219	175.9	130.5	279	224.1	166.2
40	32.1	23.8	100	80.3	59.6	160	128.5	95.3	220	176.7	131.1	280	224.9	166.8
41	32.9	24.4	101	81.1	60.2	161	129.3	95.9	221	177.5	131.7	281	225.7	167.4
42	33.7	25.0	102	81.9	60.8	162	130.1	96.5	222	178.3	132.2	282	226.5	168.0
43	34.5	25.6	103	82.7	61.4	163	130.9	97.1	223	179.1	132.8	283	227.3	168.6
44	35.3	26.2	104	83.5	62.0	164	131.7	97.7	224	179.9	133.4	284	228.1	169.2
45	36.1	26.8	105	84.3	62.6	165	132.5	98.3	225	180.7	134.0	285	228.9	169.8
46	36.9	27.4	106	85.1	63.1	166	133.3	98.9	226	181.5	134.6	286	229.7	170.4
47	37.7	28.0	107	85.9	63.7	167	134.1	99.5	227	182.3	135.2	287	230.5	171.0
48	38.6	28.6	108	86.7	64.3	168	134.9	100.1	228	183.1	135.8	288	231.3	171.6
49	39.4	29.2	109	87.5	64.9	169	135.7	100.7	229	183.9	136.4	289	232.1	172.2
50	40.2	29.8	110	88.4	65.5	170	136.5	101.3	230	184.7	137.0	290	232.9	172.8
51	41.0	30.4	111	89.2	66.1	171	137.3	101.9	231	185.5	137.6	291	233.7	173.3
52	41.8	31.0	112	90.0	66.7	172	138.1	102.5	232	186.3	138.2	292	234.5	173.9
53	42.6	31.6	113	90.8	67.3	173	138.9	103.1	233	187.1	138.8	293	235.3	174.5
54	43.4	32.2	114	91.6	67.9	174	139.8	103.7	234	187.9	139.4	294	236.1	175.1
55	44.2	32.8	115	92.4	68.5	175	140.6	104.2	235	188.8	140.0	295	236.9	175.7
56	45.0	33.4	116	93.2	69.1	176	141.4	104.8	236	189.6	140.6	296	237.7	176.3
57	45.8	34.0	117	94.0	69.7	177	142.2	105.4	237	190.4	141.2	297	238.5	176.9
58	46.6	34.6	118	94.8	70.3	178	143.0	106.0	238	191.2	141.8	298	239.4	177.5
59	47.4	35.1	119	95.6	70.9	179	143.8	106.6	239	192.0	142.4	299	240.2	178.1
60	48.2	35.7	120	96.4	71.5	180	144.6	107.2	240	192.8	143.0	300	241.0	178.7
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 4¾ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 3½ POINTS.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.6	61	47.1	38.7	121	93.5	76.8	181	139.9	114.8	241	186.3	152.9
2	01.5	01.3	62	47.9	39.3	122	94.3	77.4	182	140.7	115.5	242	187.1	153.5
3	02.3	01.9	63	48.7	40.0	123	95.1	78.0	183	141.5	116.1	243	187.8	154.2
4	03.1	02.5	64	49.5	40.6	124	95.8	78.7	184	142.2	116.7	244	188.6	154.8
5	03.9	03.2	65	50.2	41.2	125	96.6	79.3	185	143.0	117.4	245	189.4	155.4
6	04.6	03.8	66	51.0	41.9	126	97.4	79.9	186	143.8	118.0	246	190.2	156.1
7	05.4	04.4	67	51.8	42.5	127	98.2	80.6	187	144.5	118.6	247	190.9	156.7
8	06.2	05.1	68	52.6	43.1	128	98.9	81.2	188	145.3	119.3	248	191.7	157.3
9	07.0	05.7	69	53.3	43.8	129	99.7	81.8	189	146.1	119.9	249	192.5	158.0
10	07.7	06.3	70	54.1	44.4	130	100.5	82.5	190	146.9	120.5	250	193.2	158.6
11	08.5	07.0	71	54.9	45.0	131	101.3	83.1	191	147.6	121.2	251	194.0	159.2
12	09.3	07.6	72	55.7	45.7	132	102.0	83.7	192	148.4	121.8	252	194.8	159.9
13	10.0	08.2	73	56.4	46.3	133	102.8	84.4	193	149.2	122.4	253	195.6	160.5
14	10.8	08.9	74	57.2	46.9	134	103.6	85.0	194	150.0	123.1	254	196.3	161.1
15	11.6	09.5	75	58.0	47.6	135	104.4	85.6	195	150.7	123.7	255	197.1	161.8
16	12.4	10.1	76	58.7	48.2	136	105.1	86.3	196	151.5	124.3	256	197.9	162.4
17	13.1	10.8	77	59.5	48.8	137	105.9	86.9	197	152.3	125.0	257	198.7	163.0
18	13.9	11.4	78	60.3	49.5	138	106.7	87.5	198	153.1	125.6	258	199.4	163.7
19	14.7	12.0	79	61.1	50.1	139	107.4	88.2	199	153.8	126.2	259	200.2	164.3
20	15.5	12.7	80	61.8	50.7	140	108.2	88.8	200	154.6	126.9	260	201.0	164.9
21	16.2	13.3	81	62.6	51.4	141	109.0	89.4	201	155.4	127.5	261	201.8	165.6
22	17.0	14.0	82	63.4	52.0	142	109.8	90.1	202	156.1	128.1	262	202.5	166.2
23	17.8	14.6	83	64.2	52.7	143	110.5	90.7	203	156.9	128.8	263	203.3	166.8
24	18.6	15.2	84	64.9	53.3	144	111.3	91.3	204	157.7	129.4	264	204.1	167.5
25	19.3	15.9	85	65.7	53.9	145	112.1	92.0	205	158.5	130.0	265	204.8	168.1
26	20.1	16.5	86	66.5	54.6	146	112.9	92.6	206	159.2	130.7	266	205.6	168.7
27	20.9	17.1	87	67.2	55.2	147	113.6	93.3	207	160.0	131.3	267	206.4	169.4
28	21.6	17.8	88	68.0	55.8	148	114.4	93.9	208	160.8	132.0	268	207.2	170.0
29	22.4	18.4	89	68.8	56.5	149	115.2	94.5	209	161.6	132.6	269	207.9	170.6
30	23.2	19.0	90	69.6	57.1	150	115.9	95.2	210	162.3	133.2	270	208.7	171.3
31	24.0	19.7	91	70.3	57.7	151	116.7	95.8	211	163.1	133.9	271	209.5	171.9
32	24.7	20.3	92	71.1	58.4	152	117.5	96.4	212	163.9	134.5	272	210.3	172.6
33	25.5	20.9	93	71.9	59.0	153	118.3	97.1	213	164.6	135.1	273	211.0	173.2
34	26.3	21.6	94	72.7	59.6	154	119.0	97.7	214	165.4	135.8	274	211.8	173.8
35	27.1	22.2	95	73.4	60.3	155	119.8	98.3	215	166.2	136.4	275	212.6	174.5
36	27.8	22.8	96	74.2	60.9	156	120.6	99.0	216	167.0	137.0	276	213.3	175.1
37	28.6	23.5	97	75.0	61.5	157	121.4	99.6	217	167.7	137.7	277	214.1	175.7
38	29.4	24.1	98	75.7	62.2	158	122.1	100.2	218	168.5	138.3	278	214.9	176.4
39	30.1	24.7	99	76.5	62.8	159	122.9	100.9	219	169.3	138.9	279	215.7	177.0
40	30.9	25.4	100	77.3	63.4	160	123.7	101.5	220	170.1	139.6	280	216.4	177.6
41	31.7	26.0	101	78.1	64.1	161	124.4	102.1	221	170.8	140.2	281	217.2	178.3
42	32.5	26.6	102	78.8	64.7	162	125.2	102.8	222	171.6	140.8	282	218.0	178.9
43	33.2	27.3	103	79.6	65.3	163	126.0	103.4	223	172.4	141.5	283	218.8	179.5
44	34.0	27.9	104	80.4	66.0	164	126.8	104.0	224	173.1	142.1	284	219.5	180.2
45	34.8	28.5	105	81.2	66.6	165	127.5	104.7	225	173.9	142.7	285	220.3	180.8
46	35.6	29.2	106	81.9	67.2	166	128.3	105.3	226	174.7	143.4	286	221.1	181.4
47	36.3	29.8	107	82.7	67.9	167	129.1	105.9	227	175.5	144.0	287	221.8	182.1
48	37.1	30.4	108	83.5	68.5	168	129.9	106.6	228	176.2	144.6	288	222.6	182.7
49	37.9	31.1	109	84.3	69.1	169	130.6	107.2	229	177.0	145.3	289	223.4	183.3
50	38.6	31.7	110	85.0	69.8	170	131.4	107.8	230	177.8	145.9	290	224.2	184.0
51	39.4	32.3	111	85.8	70.4	171	132.2	108.5	231	178.6	146.5	291	224.9	184.6
52	40.2	33.0	112	86.6	71.0	172	133.0	109.1	232	179.3	147.2	292	225.7	185.2
53	41.0	33.6	113	87.3	71.7	173	133.7	109.7	233	180.1	147.8	293	226.5	185.9
54	41.7	34.3	114	88.1	72.3	174	134.5	110.4	234	180.9	148.4	294	227.3	186.5
55	42.5	33.9	115	88.9	73.0	175	135.3	111.0	235	181.7	149.1	295	228.0	187.1
56	43.3	35.5	116	89.7	73.6	176	136.0	111.6	236	182.4	149.7	296	228.8	187.8
57	44.1	36.2	117	90.4	74.2	177	136.8	112.3	237	183.2	150.3	297	229.6	188.4
58	44.8	36.8	118	91.2	74.9	178	137.6	112.9	238	184.0	151.0	298	230.4	189.0
59	45.6	37.4	119	92.0	75.5	179	138.4	113.6	239	184.7	151.6	299	231.1	189.7
60	46.4	38.1	120	92.8	76.1	180	139.1	114.2	240	185.5	152.3	300	231.9	190.3
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 4½ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 3¾ POINT.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.7	00.7	61	45.2	41.0	121	89.6	81.3	181	134.1	121.5	241	178.6	161.8
2	01.5	01.3	62	45.9	41.6	122	90.4	81.9	182	134.8	122.2	242	179.3	162.5
3	02.2	02.0	63	46.7	42.3	123	91.1	82.6	183	135.6	122.9	243	180.0	163.2
4	03.0	02.7	64	47.4	43.0	124	91.9	83.3	184	136.3	123.6	244	180.8	163.8
5	03.7	03.4	65	48.2	43.6	125	92.6	83.9	185	137.1	124.2	245	181.5	164.5
6	04.4	04.0	66	48.9	44.3	126	93.4	84.6	186	137.8	124.9	246	182.3	165.2
7	05.2	04.7	67	49.6	45.0	127	94.1	85.3	187	138.6	125.6	247	183.0	165.9
8	05.9	05.4	68	50.4	45.7	128	94.8	86.0	188	139.3	126.2	248	183.8	166.5
9	06.7	06.0	69	51.1	46.3	129	95.6	86.6	189	140.0	126.9	249	184.4	167.2
10	07.4	06.7	70	51.9	47.0	130	96.3	87.3	190	140.8	127.6	250	185.2	167.9
11	08.2	07.4	71	52.6	47.7	131	97.1	88.0	191	141.5	128.3	251	186.0	168.5
12	08.9	08.1	72	53.3	48.3	132	97.8	88.6	192	142.3	128.9	252	186.7	169.2
13	09.6	08.7	73	54.1	49.0	133	98.5	89.3	193	143.0	129.6	253	187.5	169.9
14	10.4	09.4	74	54.8	49.7	134	99.3	90.0	194	143.7	130.3	254	188.2	170.6
15	11.1	10.1	75	55.6	50.4	135	100.0	90.7	195	144.5	130.9	255	188.9	171.2
16	11.9	10.7	76	56.3	51.0	136	100.8	91.3	196	145.2	131.6	256	189.7	171.9
17	12.6	11.4	77	57.0	51.7	137	101.5	92.0	197	146.0	132.3	257	190.4	172.6
18	13.3	12.1	78	57.8	52.4	138	102.2	92.7	198	146.7	133.0	258	191.2	173.2
19	14.1	12.8	79	58.5	53.0	139	103.0	93.3	199	147.4	133.6	259	191.9	173.9
20	14.8	13.4	80	59.3	53.7	140	103.7	94.0	200	148.2	134.3	260	192.6	174.6
21	15.6	14.1	81	60.0	54.4	141	104.5	94.7	201	148.9	135.0	261	193.4	175.3
22	16.3	14.8	82	60.8	55.1	142	105.2	95.4	202	149.7	135.6	262	194.1	175.9
23	17.0	15.4	83	61.5	55.7	143	106.0	96.0	203	150.4	136.3	263	194.8	176.6
24	17.8	16.1	84	62.2	56.4	144	106.7	96.7	204	151.1	137.0	264	195.6	177.3
25	18.5	16.8	85	63.0	57.1	145	107.4	97.4	205	151.9	137.7	265	196.3	178.0
26	19.3	17.5	86	63.7	57.7	146	108.2	98.0	206	152.6	138.3	266	197.1	178.6
27	20.0	18.1	87	64.5	58.4	147	108.9	98.7	207	153.4	139.0	267	197.8	179.3
28	20.7	18.8	88	65.2	59.1	148	109.7	99.4	208	154.1	139.7	268	198.6	180.0
29	21.5	19.5	89	65.9	59.8	149	110.4	100.1	209	154.9	140.3	269	199.3	180.6
30	22.2	20.1	90	66.7	60.4	150	111.1	100.7	210	155.6	141.0	270	200.1	181.3
31	23.0	20.8	91	67.4	61.1	151	111.9	101.4	211	156.3	141.7	271	200.8	182.0
32	23.7	21.5	92	68.2	61.8	152	112.6	102.1	212	157.1	142.4	272	201.5	182.7
33	24.4	22.2	93	68.9	62.4	153	113.4	102.7	213	157.8	143.0	273	202.3	183.3
34	25.2	22.8	94	69.6	63.1	154	114.1	103.4	214	158.6	143.7	274	203.0	184.0
35	25.9	23.5	95	70.4	63.8	155	114.8	104.1	215	159.3	144.4	275	203.8	184.7
36	26.7	24.2	96	71.1	64.5	156	115.6	104.8	216	160.0	145.0	276	204.5	185.3
37	27.4	24.8	97	71.9	65.1	157	116.3	105.4	217	160.8	145.7	277	205.2	186.0
38	28.2	25.5	98	72.6	65.8	158	117.1	106.1	218	161.5	146.4	278	206.0	186.7
39	28.9	26.2	99	73.3	66.5	159	117.8	106.8	219	162.3	147.1	279	206.7	187.4
40	29.6	26.9	100	74.1	67.2	160	118.5	107.4	220	163.0	147.7	280	207.5	188.0
41	30.4	27.5	101	74.8	67.8	161	119.3	108.1	221	163.7	148.4	281	208.2	188.7
42	31.1	28.2	102	75.6	68.5	162	120.0	108.8	222	164.5	149.1	282	208.9	189.4
43	31.9	28.9	103	76.3	69.2	163	120.8	109.5	223	165.2	149.7	283	209.7	190.0
44	32.6	29.5	104	77.1	69.8	164	121.5	110.1	224	166.0	150.4	284	210.4	190.7
45	33.3	30.2	105	77.8	70.5	165	122.3	110.8	225	166.7	151.1	285	211.2	191.4
46	34.1	30.9	106	78.5	71.2	166	123.0	111.5	226	167.4	151.8	286	211.9	192.1
47	34.8	31.6	107	79.3	71.8	167	123.7	112.1	227	168.2	152.4	287	212.6	192.7
48	35.6	32.2	108	80.0	72.5	168	124.5	112.8	228	168.9	153.1	288	213.4	193.4
49	36.3	32.9	109	80.8	73.2	169	125.2	113.5	229	169.7	153.8	289	214.1	194.1
50	37.0	33.6	110	81.5	73.9	170	126.0	114.2	230	170.4	154.5	290	214.9	194.7
51	37.8	34.2	111	82.2	74.5	171	126.7	114.8	231	171.2	155.1	291	215.6	195.4
52	38.5	34.9	112	83.0	75.2	172	127.4	115.5	232	171.9	155.8	292	216.4	196.1
53	39.3	35.6	113	83.7	75.9	173	128.2	116.2	233	172.6	156.5	293	217.1	196.8
54	40.0	36.3	114	84.5	76.5	174	128.9	116.8	234	173.4	157.1	294	217.8	197.4
55	40.7	36.9	115	85.2	77.2	175	129.7	117.5	235	174.1	157.8	295	218.6	198.1
56	41.5	37.6	116	85.9	77.9	176	130.4	118.2	236	174.9	158.5	296	219.3	198.8
57	42.2	38.3	117	86.7	78.6	177	131.1	118.9	237	175.6	159.1	297	220.1	199.4
58	43.0	38.9	118	87.4	79.2	178	131.9	119.5	238	176.3	159.8	298	220.8	200.1
59	43.7	39.6	119	88.2	79.9	179	132.6	120.2	239	177.1	160.5	299	221.5	200.8
60	44.5	40.3	120	88.9	80.6	180	133.4	120.9	240	177.8	161.2	300	222.3	201.5
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 4¼ Points.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 4 POINTS.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.7	00.7	61	43.1	43.1	121	85.6	85.6	181	128.0	128.0	241	170.4	170.4
2	01.4	01.4	62	43.8	43.8	122	86.3	86.3	182	128.7	128.7	242	171.1	171.1
3	02.1	02.1	63	44.5	44.5	123	87.0	86.0	183	129.4	129.4	243	171.8	171.8
4	02.8	02.8	64	45.3	45.3	124	87.7	87.7	184	130.1	130.1	244	172.5	172.5
5	03.5	03.5	65	46.0	46.0	125	88.4	88.4	185	130.8	130.8	245	173.2	173.2
6	04.2	04.2	66	46.7	46.7	126	89.1	89.1	186	131.5	131.5	246	173.9	173.9
7	04.9	04.9	67	47.4	47.4	127	89.8	89.8	187	132.2	132.2	247	174.7	174.7
8	05.7	05.7	68	48.1	48.1	128	90.5	90.5	188	132.9	132.9	248	175.4	175.4
9	06.4	06.4	69	48.8	48.8	129	91.2	91.2	189	133.6	133.6	249	176.1	176.1
10	07.1	07.1	70	49.5	49.5	130	91.9	91.9	190	134.3	134.3	250	176.8	176.8
11	07.8	07.8	71	50.2	50.2	131	92.6	92.6	191	135.1	135.1	251	177.5	177.5
12	08.5	08.5	72	50.9	50.9	132	93.3	93.3	192	135.8	135.8	252	178.2	178.2
13	09.2	09.2	73	51.6	51.6	133	94.0	94.0	193	136.5	136.5	253	178.9	178.9
14	09.9	09.9	74	52.3	52.3	134	94.8	94.8	194	137.2	137.2	254	179.6	179.6
15	10.6	10.6	75	53.0	53.0	135	95.5	95.5	195	137.9	137.9	255	180.3	180.3
16	11.3	11.3	76	53.7	53.7	136	96.2	96.2	196	138.6	138.6	256	181.0	181.0
17	12.0	12.0	77	54.4	54.4	137	96.9	96.9	197	139.3	139.3	257	181.7	181.7
18	12.7	12.7	78	55.2	55.2	138	97.6	97.6	198	140.0	140.0	258	182.4	182.4
19	13.4	13.4	79	55.9	55.9	139	98.3	98.3	199	140.7	140.7	259	183.1	183.1
20	14.1	14.1	80	56.6	56.6	140	99.0	99.0	200	141.4	141.4	260	183.8	183.8
21	14.8	14.8	81	57.3	57.3	141	99.7	99.7	201	142.1	142.1	261	184.6	184.6
22	15.6	15.6	82	58.0	58.0	142	100.4	100.4	202	142.8	142.8	262	185.3	185.3
23	16.3	16.3	83	58.7	58.7	143	101.1	101.1	203	143.5	143.5	263	186.0	186.0
24	17.0	17.0	84	59.4	59.4	144	101.8	101.8	204	144.2	144.2	264	186.7	186.7
25	17.7	17.7	85	60.1	60.1	145	102.5	102.5	205	145.0	145.0	265	187.4	187.4
26	18.4	18.4	86	60.8	60.8	146	103.2	103.2	206	145.7	145.7	266	188.1	188.1
27	19.1	19.1	87	61.5	61.5	147	103.9	103.9	207	146.4	146.4	267	188.8	188.8
28	19.8	19.8	88	62.2	62.2	148	104.7	104.7	208	147.1	147.1	268	189.5	189.5
29	20.5	20.5	89	62.9	62.9	149	105.4	105.4	209	147.8	147.8	269	190.2	190.2
30	21.2	21.2	90	63.6	63.6	150	106.1	106.1	210	148.5	148.5	270	190.9	190.9
31	21.9	21.9	91	64.3	64.3	151	106.8	106.8	211	149.2	149.2	271	191.6	191.6
32	22.6	22.6	92	65.1	65.1	152	107.5	107.5	212	149.9	149.9	272	192.3	192.3
33	23.3	23.3	93	65.8	65.8	153	108.2	108.2	213	150.6	150.6	273	193.0	193.0
34	24.0	24.0	94	66.5	66.5	154	108.9	108.9	214	151.3	151.3	274	193.7	193.7
35	24.7	24.7	95	67.2	67.2	155	109.6	109.6	215	152.0	152.0	275	194.5	194.5
36	25.5	25.5	96	67.9	67.9	156	110.3	110.3	216	152.7	152.7	276	195.2	195.2
37	26.2	26.2	97	68.6	68.6	157	111.0	111.0	217	153.4	153.4	277	195.9	195.9
38	26.9	26.9	98	69.3	69.3	158	111.7	111.7	218	154.1	154.1	278	196.6	196.6
39	27.6	27.6	99	70.0	70.0	159	112.4	112.4	219	154.9	154.9	279	197.3	197.3
40	28.3	28.3	100	70.7	70.7	160	113.1	113.1	220	155.6	155.6	280	198.0	198.0
41	29.0	29.0	101	71.4	71.4	161	113.8	113.8	221	156.3	156.3	281	198.7	198.7
42	29.7	29.7	102	72.1	72.1	162	114.5	114.5	222	157.0	157.0	282	199.4	199.4
43	30.4	30.4	103	72.8	72.8	163	115.3	115.3	223	157.7	157.7	283	200.1	200.1
44	31.1	31.1	104	73.5	73.5	164	116.0	116.0	224	158.4	158.4	284	200.8	200.8
45	31.8	31.8	105	74.2	74.2	165	116.7	116.7	225	159.1	159.1	285	201.5	201.5
46	32.5	32.5	106	75.0	75.0	166	117.4	117.4	226	159.8	159.8	286	202.2	202.2
47	33.2	33.2	107	75.7	75.7	167	118.1	118.1	227	160.5	160 5	287	202.9	202.9
48	33.9	33.9	108	76 4	76.4	168	118.8	118 8	228	161.2	161.2	288	203.6	203.6
49	34.6	34.6	109	77.1	77.1	169	119.5	119.5	229	161.9	161.9	289	204.3	204.3
50	35.4	35 4	110	77.8	77.8	170	120.2	120.2	230	162.6	162.6	290	205.1	205.1
51	36.1	36.1	111	78.5	78.5	171	120.9	120.9	231	163.3	163.3	291	205.8	205.8
52	36.8	36.8	112	79.2	79.2	172	121.6	121.6	232	164.0	164.0	292	206.5	206.5
53	37.5	37.5	113	79.9	79.9	173	122.3	122.3	233	164.8	164.8	293	207.2	207.2
54	38.2	38.2	114	80.6	80.6	174	123.0	123.0	234	165.5	165.5	294	207.9	207.9
55	38.9	38.9	115	81.3	81.3	175	123.7	123.7	235	166.2	166.2	295	208.6	208.6
56	39.6	39.6	116	82.0	82.0	176	124.4	124.4	236	166.9	166.9	296	209.3	209.3
57	40.3	40.3	117	82.7	82.7	177	125.2	125.2	237	167.6	167.6	297	210.0	210.0
58	41.0	41 0	118	83.4	83.4	178	125.9	125.9	238	168.3	168.3	298	210.7	210.7
59	41.7	41.7	119	84.1	84.1	179	126.6	126.6	239	169.0	169.0	299	211.4	211.4
60	42.4	42.4	120	84.8	84.8	180	127.3	127.3	240	169.7	169.7	300	212.1	212.1
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 4 Points.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 1 DEGREE.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.0	61	61.0	01.1	121	121.0	02.1	181	181.0	03.2	241	241.0	04.2
2	02.0	00.0	62	62.0	01.1	122	122.0	02.1	182	182.0	03.2	242	242.0	04.2
3	03.0	00.1	63	63.0	01.1	123	123.0	02.1	183	183.0	03.2	243	243.0	04.2
4	04.0	00.1	64	64.0	01.1	124	124.0	02.2	184	184.0	03.2	244	244.0	04.3
5	05.0	00.1	65	65.0	01.1	125	125.0	02.2	185	185.0	03.2	245	245.0	04.3
6	06.0	00.1	66	66.0	01.2	126	126.0	02.2	186	186.0	03.2	246	246.0	04.3
7	07.0	00.1	67	67.0	01.2	127	127.0	02.2	187	187.0	03.3	247	247.0	04.3
8	08.0	00.1	68	68.0	01.2	128	128.0	02.2	188	188.0	03.3	248	248.0	04.3
9	09.0	00.2	69	69.0	01.2	129	129.0	02.2	189	189.0	03.3	249	249.0	04.3
10	10.0	00.2	70	70.0	01.2	130	130.0	02.3	190	190.0	03.3	250	250.0	04.4
11	11.0	00.2	71	71.0	01.2	131	131.0	02.3	191	191.0	03.3	251	251.0	04.4
12	12.0	00.2	72	72.0	01.3	132	132.0	02.3	192	192.0	03.4	252	252.0	04.4
13	13.0	00.2	73	73.0	01.3	133	133.0	02.3	193	193.0	03.4	253	253.0	04.4
14	14.0	00.2	74	74.0	01.3	134	134.0	02.3	194	194.0	03.4	254	254.0	04.4
15	15.0	00.3	75	75.0	01.3	135	135.0	02.4	195	195.0	03.4	255	255.0	04.4
16	16.0	00.3	76	76.0	01.3	136	136.0	02.4	196	196.0	03.4	256	256.0	04.5
17	17.0	00.3	77	77.0	01.3	137	137.0	02.4	197	197.0	03.4	257	257.0	04.5
18	18.0	00.3	78	78.0	01.4	138	138.0	02.4	198	198.0	03.5	258	258.0	04.5
19	19.0	00.3	79	79.0	01.4	139	139.0	02.4	199	199.0	03.5	259	259.0	04.5
20	20.0	00.3	80	80.0	01.4	140	140.0	02.4	200	200.0	03.5	260	260.0	04.5
21	21.0	00.4	81	81.0	01.4	141	141.0	02.5	201	201.0	03.5	261	261.0	04.5
22	22.0	00.4	82	82.0	01.4	142	142.0	02.5	202	202.0	03.5	262	262.0	04.6
23	23.0	00.4	83	83.0	01.4	143	143.0	02.5	203	203.0	03.5	263	263.0	04.6
24	24.0	00.4	84	84.0	01.5	144	144.0	02.5	204	204.0	03.6	264	264.0	04.6
25	25.0	00.4	85	85.0	01.5	145	145.0	02.5	205	205.0	03.6	265	265.0	04.6
26	26.0	00.5	86	86.0	01.5	146	146.0	02.5	206	206.0	03.6	266	266.0	04.6
27	27.0	00.5	87	87.0	01.5	147	147.0	02.6	207	207.0	03.6	267	267.0	04.7
28	28.0	00.5	88	88.0	01.5	148	148.0	02.6	208	208.0	03.6	268	268.0	04.7
29	29.0	00.5	89	89.0	01.6	149	149.0	02.6	209	209.0	03.7	269	269.0	04.7
30	30.0	00.5	90	90.0	01.6	150	150.0	02.6	210	210.0	03.7	270	270.0	04.7
31	31.0	00.5	91	91.0	01.6	151	151.0	02.6	211	211.0	03.7	271	271.0	04.7
32	32.0	00.6	92	92.0	01.6	152	152.0	02.7	212	212.0	03.7	272	272.0	04.7
33	33.0	00.6	93	93.0	01.6	153	153.0	02.7	213	213.0	03.7	273	273.0	04.8
34	34.0	00.6	94	94.0	01.6	154	154.0	02.7	214	214.0	03.7	274	274.0	04.8
35	35.0	00.6	95	95.0	01.7	155	155.0	02.7	215	215.0	03.8	275	275.0	04.8
36	36.0	00.6	96	96.0	01.7	156	156.0	02.7	216	216.0	03.8	276	276.0	04.8
37	37.0	00.6	97	97.0	01.7	157	157.0	02.7	217	217.0	03.8	277	277.0	04.8
38	38.0	00.7	98	98.0	01.7	158	158.0	02.8	218	218.0	03.8	278	278.0	04.9
39	39.0	00.7	99	99.0	01.7	159	159.0	02.8	219	219.0	03.8	279	279.0	04.9
40	40.0	00.7	100	100.0	01.7	160	160.0	02.8	220	220.0	03.8	280	280.0	04.9
41	41.0	00.7	101	101.0	01.8	161	161.0	02.8	221	221.0	03.9	281	281.0	04.9
42	42.0	00.7	102	102.0	01.8	162	162.0	02.8	222	222.0	03.9	282	282.0	04.9
43	43.0	00.8	103	103.0	01.8	163	163.0	02.8	223	223.0	03.9	283	283.0	04.9
44	44.0	00.8	104	104.0	01.8	164	164.0	02.9	224	224.0	03.9	284	284.0	05.0
45	45.0	00.8	105	105.0	01.8	165	165.0	02.9	225	225.0	03.9	285	285.0	05.0
46	46.0	00.8	106	106.0	01.8	166	166.0	02.9	226	226.0	03.9	286	286.0	05.0
47	47.0	00.8	107	107.0	01.9	167	167.0	02.9	227	227.0	04.0	287	287.0	05.0
48	48.0	00.8	108	108.0	01.9	168	168.0	02.9	228	228.0	04.0	288	288.0	05.0
49	49.0	00.9	109	109.0	01.9	169	169.0	02.9	229	229.0	04.0	289	289.0	05.0
50	50.0	00.9	110	110.0	01.9	170	170.0	03.0	230	230.0	04.0	290	290.0	05.1
51	51.0	00.9	111	111.0	01.9	171	171.0	03.0	231	231.0	04.0	291	291.0	05.1
52	52.0	00.9	112	112.0	02.0	172	172.0	03.0	232	232.0	04.0	292	292.0	05.1
53	53.0	00.9	113	113.0	02.0	173	173.0	03.0	233	233.0	04.1	293	293.0	05.1
54	54.0	00.9	114	114.0	02.0	174	174.0	03.0	234	234.0	04.1	294	294.0	05.1
55	55.0	01.0	115	115.0	02.0	175	175.0	03.1	235	235.0	04.1	295	295.0	05.1
56	56.0	01.0	116	116.0	02.0	176	176.0	03.1	236	236.0	04.1	296	296.0	05.2
57	57.0	01.0	117	117.0	02.0	177	177.0	03.1	237	237.0	04.1	297	297.0	05.2
58	58.0	01.0	118	118.0	02.1	178	178.0	03.1	238	238.0	04.2	298	298.0	05.2
59	59.0	01.0	119	119.0	02.1	179	179.0	03.1	239	239.0	04.2	299	299.0	05.2
60	60.0	01.0	120	120.0	02.1	180	180.0	03.1	240	240.0	04.2	300	300.0	05.2
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 89 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 2 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.0	61	61.0	02.1	121	120.9	04.2	181	180.9	06.3	241	240.9	08.4
2	02.0	00.1	62	62.0	02.2	122	121.9	04.3	182	181.9	06.4	242	241.9	08.4
3	03.0	00.1	63	63.0	02.2	123	122.9	04.3	183	182.9	06.4	243	242.9	08.5
4	04.0	00.1	64	64.0	02.2	124	123.9	04.3	184	183.9	06.4	244	243.9	08.5
5	05.0	00.2	65	65.0	02.3	125	124.9	04.4	185	184.9	06.5	245	244.9	08.6
6	06.0	00.2	66	66.0	02.3	126	125.9	04.4	186	185.9	06.5	246	245.8	08.6
7	07.0	00.2	67	67.0	02.3	127	126.9	04.4	187	186.9	06.5	247	246.8	08.6
8	08.0	00.3	68	68.0	02.4	128	127.9	04.5	188	187.9	06.6	248	247.8	08.7
9	09.0	00.3	69	69.0	02.4	129	128.9	04.5	189	188.9	06.6	249	248.8	08.7
10	10.0	00.3	70	70.0	02.4	130	129.9	04.5	190	189.9	06.6	250	249.8	08.7
11	11.0	00.4	71	71.0	02.5	131	130.9	04.6	191	190.9	06.7	251	250.8	08.8
12	12.0	00.4	72	72.0	02.5	132	131.9	04.6	192	191.9	06.7	252	251.8	08.8
13	13.0	00.5	73	73.0	02.5	133	132.9	04.6	193	192.9	06.7	253	252.8	08.8
14	14.0	00.5	74	74.0	02.6	134	133.9	04.7	194	193.9	06.8	254	253.8	08.9
15	15.0	00.5	75	75.0	02.6	135	134.9	04.7	195	194.9	06.8	255	254.8	08.9
16	16.0	00.6	76	76.0	02.7	136	135.9	04.7	196	195.9	06.8	256	255.8	08.9
17	17.0	00.6	77	77.0	02.7	137	136.9	04.8	197	196.9	06.9	257	256.8	09.0
18	18.0	00.6	78	78.0	02.7	138	137.9	04.8	198	197.9	06.9	258	257.8	09.0
19	19.0	00.7	79	79.0	02.8	139	138.9	04.9	199	198.9	06.9	259	258.8	09.0
20	20.0	00.7	80	80.0	02.8	140	139.9	04.9	200	199.9	07.0	260	259.8	09.1
21	21.0	00.7	81	81.0	02.8	141	140.9	04.9	201	200.9	07.0	261	260.8	09.1
22	22.0	00.8	82	81.9	02.9	142	141.9	05.0	202	201.9	07.0	262	261.8	09.1
23	23.0	00.8	83	82.9	02.9	143	142.9	05.0	203	202.9	07.1	263	262.8	09.2
24	24.0	00.8	84	83.9	02.9	144	143.9	05.0	204	203.9	07.1	264	263.8	09.2
25	25.0	00.9	85	84.9	03.0	145	144.9	05.1	205	204.9	07.2	265	264.8	09.2
26	26.0	00.9	86	85.9	03.0	146	145.9	05.1	206	205.9	07.2	266	265.8	09.3
27	27.0	00.9	87	86.9	03.0	147	146.9	05.1	207	206.9	07.2	267	266.8	09.3
28	28.0	01.0	88	87.9	03.1	148	147.9	05.2	208	207.9	07.3	268	267.8	09.4
29	29.0	01.0	89	88.9	03.1	149	148.9	05.2	209	208.9	07.3	269	268.8	09.4
30	30.0	01.0	90	89.9	03.1	150	149.9	05.2	210	209.9	07.3	270	269.8	09.4
31	31.0	01.1	91	90.9	03.2	151	150.9	05.3	211	210.9	07.4	271	270.8	09.5
32	32.0	01.1	92	91.9	03.2	152	151.9	05.3	212	211.9	07.4	272	271.8	09.5
33	33.0	01.2	93	92.9	03.2	153	152.9	05.3	213	212.9	07.4	273	272.8	09.5
34	34.0	01.2	94	93.9	03.3	154	153.9	05.4	214	213.9	07.5	274	273.8	09.6
35	35.0	01.2	95	94.9	03.3	155	154.9	05.4	215	214.9	07.5	275	274.8	09.6
36	36.0	01.3	96	95.9	03.4	156	155.9	05.4	216	215.9	07.5	276	275.8	09.6
37	37.0	01.3	97	96.9	03.4	157	156.9	05.5	217	216.9	07.6	277	276.8	09.7
38	38.0	01.3	98	97.9	03.4	158	157.9	05.5	218	217.9	07.6	278	277.8	09.7
39	39.0	01.4	99	98.9	03.5	159	158.9	05.5	219	218.9	07.6	279	278.8	09.7
40	40.0	01.4	100	99.9	03.5	160	159.9	05.6	220	219.9	07.7	280	279.8	09.8
41	41.0	01.4	101	100.9	03.5	161	160.9	05.6	221	220.9	07.7	281	280.8	09.8
42	42.0	01.5	102	101.9	03.6	162	161.9	05.7	222	221.9	07.7	282	281.8	09.8
43	43.0	01.5	103	102.9	03.6	163	162.9	05.7	223	222.9	07.8	283	282.8	09.9
44	44.0	01.5	104	103.9	03.6	164	163.9	05.7	224	223.9	07.8	284	283.8	09.9
45	45.0	01.6	105	104.9	03.7	165	164.9	05.8	225	224.9	07.9	285	284.8	09.9
46	46.0	01.6	106	105.9	03.7	166	165.9	05.8	226	225.9	07.9	286	285.8	10.0
47	47.0	01.6	107	106.9	03.7	167	166.9	05.8	227	226.9	07.9	287	286.8	10.0
48	48.0	01.7	108	107.9	03.8	168	167.9	05.9	228	227.9	08.0	288	287.8	10.1
49	49.0	01.7	109	108.9	03.8	169	168.9	05.9	229	228.9	08.0	289	288.8	10.1
50	50.0	01.7	110	109.9	03.8	170	169.9	05.9	230	229.9	08.0	290	289.8	10.1
51	51.0	01.8	111	110.9	03.9	171	170.9	06.0	231	230.9	08.1	291	290.8	10.2
52	52.0	01.8	112	111.9	03.9	172	171.9	06.0	232	231.9	08.1	292	291.8	10.2
53	53.0	01.8	113	112.9	03.9	173	172.9	06.0	233	232.9	08.1	293	292.8	10.2
54	54.0	01.9	114	113.9	04.0	174	173.9	06.1	234	233.9	08.2	294	293.8	10.3
55	55.0	01.9	115	114.9	04.0	175	174.9	06.1	235	234.9	08.2	295	294.8	10.3
56	56.0	02.0	116	115.9	04.0	176	175.9	06.1	236	235.9	08.2	296	295.8	10.3
57	57.0	02.0	117	116.9	04.1	177	176.9	06.2	237	236.9	08.3	297	296.8	10.4
58	58.0	02.0	118	117.9	04.1	178	177.9	06.2	238	237.9	08.3	298	297.8	10.4
59	59.0	02.1	119	118.9	04.2	179	178.9	06.2	239	238.9	08.3	299	298.8	10.4
60	60.0	02.1	120	119.9	04.2	180	179.9	06.3	240	239.9	08.4	300	299.8	10.5
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 88 Degrees.

TABLE III.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 3 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.1	61	60.9	03.2	121	120.8	06.3	181	180.8	09.5	241	240.7	12.6
2	02.0	00.1	62	61.9	03.2	122	121.8	06.4	182	181.8	09.5	242	241.7	12.7
3	03.0	00.2	63	62.9	03.3	123	122.8	06.4	183	182.7	09.6	243	242.7	12.7
4	04.0	00.2	64	63.9	03.3	124	123.8	06.5	184	183.7	09.6	244	243.7	12.8
5	05.0	00.3	65	64.9	03.4	125	124.8	06.5	185	184.7	09.7	245	244.7	12.8
6	06.0	00.3	66	65.9	03.5	126	125.8	06.6	186	185.7	09.7	246	245.7	12.9
7	07.0	00.4	67	66.9	03.5	127	126.8	06.6	187	186.7	09.8	247	246.7	12.9
8	08.0	00.4	68	67.9	03.6	128	127.8	06.7	188	187.7	09.8	248	247.7	13.0
9	09.0	00.5	69	68.9	03.6	129	128.8	06.8	189	188.7	09.9	249	248.7	13.0
10	10.0	00.5	70	69.9	03.7	130	129.8	06.8	190	189.7	09.9	250	249.7	13.1
11	11.0	00.6	71	70.9	03.7	131	130.8	06.9	191	190.7	10.0	251	250.7	13.1
12	12.0	00.6	72	71.9	03.8	132	131.8	06.9	192	191.7	10.0	252	251.7	13.2
13	13.0	00.7	73	72.9	03.8	133	132.8	07.0	193	192.7	10.1	253	252.7	13.2
14	14.0	00.7	74	73.9	03.9	134	133.8	07.0	194	193.7	10.2	254	253.7	13.3
15	15.0	00.8	75	74.9	03.9	135	134.8	07.1	195	194.7	10.2	255	254.7	13.3
16	16.0	00.8	76	75.9	04.0	136	135.8	07.1	196	195.7	10.3	256	255.6	13.4
17	17.0	00.9	77	76.9	04.0	137	136.8	07.2	197	196.7	10.3	257	256.6	13.5
18	18.0	00.9	78	77.9	04.1	138	137.8	07.2	198	197.7	10.4	258	257.6	13.5
19	19.0	01.0	79	78.9	04.1	139	138.8	07.3	199	198.7	10.4	259	258.6	13.6
20	20.0	01.0	80	79.9	04.2	140	139.8	07.3	200	199.7	10.5	260	259.6	13.6
21	21.0	01.1	81	80.9	04.2	141	140.8	07.4	201	200.7	10.5	261	260.6	13.7
22	22.0	01.2	82	81.9	04.3	142	141.8	07.4	202	201.7	10.6	262	261.6	13.7
23	23.0	01.2	83	82.9	04.3	143	142.8	07.5	203	202.7	10.6	263	262.6	13.8
24	24.0	01.3	84	83.9	04.4	144	143.8	07.5	204	203.7	10.7	264	263.6	13.8
25	25.0	01.3	85	84.9	04.4	145	144.8	07.6	205	204.7	10.7	265	264.6	13.9
26	26.0	01.4	86	85.9	04.5	146	145.8	07.6	206	205.7	10.8	266	265.6	13.9
27	27.0	01.4	87	86.9	04.6	147	146.8	07.7	207	206.7	10.8	267	266.6	14.0
28	28.0	01.5	88	87.9	04.6	148	147.8	07.7	208	207.7	10.9	268	267.6	14.0
29	29.0	01.5	89	88.9	04.7	149	148.8	07.8	209	208.7	10.9	269	268.6	14.1
30	30.0	01.6	90	89.9	04.7	150	149.8	07.9	210	209.7	11.0	270	269.6	14.1
31	31.0	01.6	91	90.9	04.8	151	150.8	07.9	211	210.7	11.0	271	270.6	14.2
32	32.0	01.7	92	91.9	04.8	152	151.8	08.0	212	211.7	11.1	272	271.6	14.2
33	33.0	01.7	93	92.9	04.9	153	152.8	08.0	213	212.7	11.1	273	272.6	14.3
34	34.0	01.8	94	93.9	04.9	154	153.8	08.1	214	213.7	11.2	274	273.6	14.3
35	35.0	01.8	95	94.9	05.0	155	154.8	08.1	215	214.7	11.3	275	274.6	14.4
36	36.0	01.9	96	95.9	05.0	156	155.8	08.2	216	215.7	11.3	276	275.6	14.4
37	36.9	01.9	97	96.9	05.1	157	156.8	08.2	217	216.7	11.4	277	276.6	14.5
38	37.9	02.0	98	97.9	05.1	158	157.8	08.3	218	217.7	11.4	278	277.6	14.5
39	38.9	02.0	99	98.9	05.2	159	158.8	08.3	219	218.7	11.5	279	278.6	14.6
40	39.9	02.1	100	99.9	05.2	160	159.8	08.4	220	219.7	11.5	280	279.6	14.7
41	40.9	02.1	101	100.9	05.3	161	160.8	08.4	221	220.7	11.6	281	280.6	14.7
42	41.9	02.2	102	101.9	05.3	162	161.8	08.5	222	221.7	11.6	282	281.6	14.8
43	42.9	02.3	103	102.9	05.4	163	162.8	08.5	223	222.7	11.7	283	282.6	14.8
44	43.9	02.3	104	103.9	05.4	164	163.8	08.6	224	223.7	11.7	284	283.6	14.9
45	44.9	02.4	105	104.9	05.5	165	164.8	08.6	225	224.7	11.8	285	284.6	14.9
46	45.9	02.4	106	105.9	05.5	166	165.8	08.7	226	225.7	11.8	286	285.6	15.0
47	46.9	02.5	107	106.9	05.6	167	166.8	08.7	227	226.7	11.9	287	286.6	15.0
48	47.9	02.5	108	107.9	05.7	168	167.8	08.8	228	227.7	11.9	288	287.6	15.1
49	48.9	02.6	109	108.9	05.7	169	168.8	08.8	229	228.7	12.0	289	288.6	15.1
50	49.9	02.6	110	109.8	05.8	170	169.8	08.9	230	229.7	12.0	290	289.6	15.2
51	50.9	02.7	111	110.8	05.8	171	170.8	08.9	231	230.7	12.1	291	290.6	15.2
52	51.9	02.7	112	111.8	05.9	172	171.8	09.0	232	231.7	12.1	292	291.6	15.3
53	52.9	02.8	113	112.8	05.9	173	172.8	09.1	233	232.7	12.2	293	292.6	15.3
54	53.9	02.8	114	113.8	06.0	174	173.8	09.1	234	233.7	12.2	294	293.6	15.4
55	54.9	02.9	115	114.8	06.0	175	174.8	09.2	235	234.7	12.3	295	294.6	15.4
56	55.9	02.9	116	115.8	06.1	176	175.8	09.2	236	235.7	12.4	296	295.6	15.5
57	56.9	03.0	117	116.8	06.1	177	176.8	09.3	237	236.7	12.4	297	296.6	15.5
58	57.9	03.0	118	117.8	06.2	178	177.8	09.3	238	237.7	12.5	298	297.6	15.6
59	58.9	03.1	119	118.8	06.2	179	178.8	09.4	239	238.7	12.5	299	298.6	15.6
60	59.9	03.1	120	119.8	06.3	180	179.8	09.4	240	239.7	12.6	300	299.6	15.7
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 87 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 4 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.1	61	60.9	04.3	121	120.7	08.4	181	180.6	12.6	241	240.4	16.8
2	02.0	00.1	62	61.8	04.3	122	121.7	08.5	182	181.6	12.7	242	241.4	16.9
3	03.0	00.2	63	62.8	04.4	123	122.7	08.6	183	182.6	12.8	243	242.4	17.0
4	04.0	00.3	64	63.8	04.5	124	123.7	08.6	184	183.6	12.8	244	243.4	17.0
5	05.0	00.3	65	64.8	04.5	125	124.7	08.7	185	184.5	12.9	245	244.4	17.1
6	06.0	00.4	66	65.8	04.6	126	125.7	08.8	186	185.5	13.0	246	245.4	17.2
7	07.0	00.5	67	66.8	04.7	127	126.7	08.9	187	186.5	13.0	247	246.4	17.2
8	08.0	00.6	68	67.8	04.7	128	127.7	08.9	188	187.5	13.1	248	247.4	17.3
9	09.0	00.6	69	68.8	04.8	129	128.7	09.0	189	188.5	13.2	249	248.4	17.4
10	10.0	00.7	70	69.8	04.9	130	129.7	09.1	190	189.5	13.3	250	249.4	17.4
11	11.0	00.8	71	70.8	05.0	131	130.7	09.1	191	190.5	13.3	251	250.4	17.5
12	12.0	00.8	72	71.8	05.0	132	131.7	09.2	192	191.5	13.4	252	251.4	17.6
13	13.0	00.9	73	72.8	05.1	133	132.7	09.3	193	192.5	13.5	253	252.4	17.6
14	14.0	01.0	74	73.8	05.2	134	133.7	09.3	194	193.5	13.5	254	253.4	17.7
15	15.0	01.0	75	74.8	05.2	135	134.7	09.4	195	194.5	13.6	255	254.4	17.8
16	16.0	01.1	76	75.8	05.3	136	135.7	09.5	196	195.5	13.7	256	255.4	17.9
17	17.0	01.2	77	76.8	05.4	137	136.7	09.6	197	196.5	13.7	257	256.4	17.9
18	18.0	01.3	78	77.8	05.4	138	137.7	09.6	198	197.5	13.8	258	257.4	18.0
19	19.0	01.3	79	78.8	05.5	139	138.7	09.7	199	198.5	13.9	259	258.4	18.1
20	20.0	01.4	80	79.8	05.6	140	139.7	09.8	200	199.5	14.0	260	259.4	18.1
21	20.9	01.5	81	80.8	05.7	141	140.7	09.8	201	200.5	14.0	261	260.4	18.2
22	21.9	01.5	82	81.8	05.7	142	141.7	09.9	202	201.5	14.1	262	261.4	18.3
23	22.9	01.6	83	82.8	05.8	143	142.7	10.0	203	202.5	14.2	263	262.4	18.3
24	23.9	01.7	84	83.8	05.9	144	143.6	10.0	204	203.5	14.2	264	263.4	18.4
25	24.9	01.7	85	84.8	05.9	145	144.6	10.1	205	204.5	14.3	265	264.4	18.5
26	25.9	01.8	86	85.8	06.0	146	145.6	10.2	206	205.5	14.4	266	265.4	18.6
27	26.9	01.9	87	86.8	06.1	147	146.6	10.3	207	206.5	14.4	267	266.3	18.6
28	27.9	02.0	88	87.8	06.1	148	147.6	10.3	208	207.5	14.5	268	267.3	18.7
29	28.9	02.0	89	88.8	06.2	149	148.6	10.4	209	208.5	14.6	269	268.3	18.8
30	29.9	02.1	90	89.8	06.3	150	149.6	10.5	210	209.5	14.6	270	269.3	18.8
31	30.9	02.2	91	90.8	06.3	151	150.6	10.5	211	210.5	14.7	271	270.3	18.9
32	31.9	02.2	92	91.8	06.4	152	151.6	10.6	212	211.5	14.8	272	271.3	19.0
33	32.9	02.3	93	92.8	06.5	153	152.6	10.7	213	212.5	14.9	273	272.3	19.0
34	33.9	02.4	94	93.8	06.6	154	153.6	10.7	214	213.5	14.9	274	273.3	19.1
35	34.9	02.4	95	94.8	06.6	155	154.6	10.8	215	214.5	15.0	275	274.3	19.2
36	35.9	02.5	96	95.8	06.7	156	155.6	10.9	216	215.5	15.1	276	275.3	19.3
37	36.9	02.6	97	96.8	06.8	157	156.6	11.0	217	216.5	15.1	277	276.3	19.3
38	37.9	02.7	98	97.8	06.8	158	157.6	11.0	218	217.5	15.2	278	277.3	19.4
39	38.9	02.7	99	98.8	06.9	159	158.6	11.1	219	218.5	15.3	279	278.3	19.5
40	39.9	02.8	100	99.8	07.0	160	159.6	11.2	220	219.5	15.3	280	279.3	19.5
41	40.9	02.9	101	100.8	07.0	161	160.6	11.2	221	220.5	15.4	281	280.3	19.6
42	41.9	02.9	102	101.8	07.1	162	161.6	11.3	222	221.5	15.5	282	281.3	19.7
43	42.9	03.0	103	102.7	07.2	163	162.6	11.4	223	222.5	15.6	283	282.3	19.7
44	43.9	03.1	104	103.7	07.3	164	163.6	11.4	224	223.5	15.6	284	283.3	19.8
45	44.9	03.1	105	104.7	07.3	165	164.6	11.5	225	224.5	15.7	285	284.3	19.9
46	45.9	03.2	106	105.7	07.4	166	165.6	11.6	226	225.4	15.8	286	285.3	20.0
47	46.9	03.3	107	106.7	07.5	167	166.6	11.6	227	226.4	15.8	287	286.3	20.0
48	47.9	03.3	108	107.7	07.5	168	167.6	11.7	228	227.4	15.9	288	287.3	20.1
49	48.9	03.4	109	108.7	07.6	169	168.6	11.8	229	228.4	16.0	289	288.3	20.2
50	49.9	03.5	110	109.7	07.7	170	169.6	11.9	230	229.4	16.0	290	289.3	20.2
51	50.9	03.6	111	110.7	07.7	171	170.6	11.9	231	230.4	16.1	291	290.3	20.3
52	51.9	03.6	112	111.7	07.8	172	171.6	12.0	232	231.4	16.2	292	291.3	20.4
53	52.9	03.7	113	112.7	07.9	173	172.6	12.1	233	232.4	16.3	293	292.3	20.4
54	53.9	03.8	114	113.7	08.0	174	173.6	12.1	234	233.4	16.3	294	293.3	20.5
55	54.9	03.8	115	114.7	08.0	175	174.6	12.2	235	234.4	16.4	295	294.3	20.6
56	55.9	03.9	116	115.7	08.1	176	175.6	12.3	236	235.4	16.5	296	295.3	20.6
57	56.9	04.0	117	116.7	08.1	177	176.6	12.3	237	236.4	16.5	297	296.3	20.7
58	57.9	04.0	118	117.7	08.2	178	177.6	12.4	238	237.4	16.6	298	297.3	20.8
59	58.9	04.1	119	118.7	08.3	179	178.6	12.5	239	238.4	16.7	299	298.3	20.9
60	59.9	04.2	120	119.7	08.4	180	179.6	12.6	240	239.4	16.7	300	299.3	20.9
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 86 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 5 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.1	61	60.8	05.3	121	120.5	10.5	181	180.3	15.8	241	240.1	21.0
2	02.0	00.2	62	61.8	05.4	122	121.5	10.6	182	181.3	15.9	242	241.1	21.1
3	03.0	00.3	63	62.8	05.5	123	122.5	10.7	183	182.3	15.9	243	242.1	21.2
4	04.0	00.3	64	63.8	05.6	124	123.5	10.8	184	183.3	16.0	244	243.1	21.3
5	05.0	00.4	65	64.8	05.7	125	124.5	10.9	185	184.3	16.1	245	244.1	21.4
6	06.0	00.5	66	65.7	05.8	126	125.5	11.0	186	185.3	16.2	246	245.1	21.4
7	07.0	00.6	67	66.7	05.8	127	126.5	11.1	187	186.3	16.3	247	246.1	21.5
8	08.0	00.7	68	67.7	05.9	128	127.5	11.2	188	187.3	16.4	248	247.1	21.6
9	09.0	00.8	69	68.7	06.0	129	128.5	11.2	189	188.3	16.5	249	248.1	21.7
10	10.0	00.9	70	69.7	06.1	130	129.5	11.3	190	189.3	16.6	250	249.0	21.7
11	11.0	01.0	71	70.7	06.2	131	130.5	11.4	191	190.3	16.6	251	250.0	21.9
12	12.0	01.0	72	71.7	06.3	132	131.5	11.5	192	191.3	16.7	252	251.0	22.0
13	13.0	01.1	73	72.7	06.4	133	132.5	11.6	193	192.3	16.8	253	252.0	22.1
14	13.9	01.2	74	73.7	06.4	134	133.5	11.7	194	193.3	16.9	254	253.0	22.1
15	14.9	01.3	75	74.7	06.5	135	134.5	11.8	195	194.3	17.0	255	254.0	22.2
16	15.9	01.4	76	75.7	06.6	136	135.5	11.9	196	195.3	17.1	256	255.0	22.3
17	16.9	01.5	77	76.7	06.7	137	136.5	11.9	197	196.3	17.2	257	256.0	22.4
18	17.9	01.6	78	77.7	06.8	138	137.5	12.0	198	197.2	17.3	258	257.0	22.5
19	18.9	01.7	79	78.7	06.9	139	138.5	12.1	199	198.2	17.3	259	258.0	22.6
20	19.9	01.7	80	79.7	07.0	140	139.5	12.2	200	199.2	17.4	260	259.0	22.7
21	20.9	01.8	81	80.7	07.1	141	140.5	12.3	201	200.2	17.5	261	260.0	22.7
22	21.9	01.9	82	81.7	07.1	142	141.5	12.4	202	201.2	17.6	262	261.0	22.8
23	22.9	02.0	83	82.7	07.2	143	142.5	12.5	203	202.2	17.7	263	262.0	22.9
24	23.9	02.1	84	83.7	07.3	144	143.5	12.6	204	203.2	17.8	264	263.0	23.0
25	24.9	02.2	85	84.7	07.4	145	144.4	12.6	205	204.2	17.9	265	264.0	23.1
26	25.9	02.3	86	85.7	07.5	146	145.4	12.7	206	205.2	18.0	266	265.0	23.2
27	26.9	02.4	87	86.7	07.6	147	146.4	12.8	207	206.2	18.0	267	266.0	23.3
28	27.9	02.4	88	87.7	07.7	148	147.4	12.9	208	207.2	18.1	268	267.0	23.4
29	28.9	02.5	89	88.7	07.8	149	148.4	13.0	209	208.2	18.2	269	268.0	23.4
30	29.9	02.6	90	89.7	07.8	150	149.4	13.1	210	209.2	18.3	270	269.0	23.5
31	30.9	02.7	91	90.7	07.9	151	150.4	13.2	211	210.2	18.4	271	270.0	23.6
32	31.9	02.8	92	91.6	08.0	152	151.4	13.2	212	211.2	18.5	272	271.0	23.7
33	32.9	02.9	93	92.6	08.1	153	152.4	13.3	213	212.2	18.6	273	272.0	23.8
34	33.9	03.0	94	93.6	08.2	154	153.4	13.4	214	213.2	18.7	274	273.0	23.9
35	34.9	03.1	95	94.6	08.3	155	154.4	13.5	215	214.2	18.7	275	274.0	24.0
36	35.9	03.1	96	95.6	08.4	156	155.4	13.6	216	215.2	18.8	276	274.9	24.1
37	36.9	03.2	97	96.6	08.5	157	156.4	13.7	217	216.2	18.9	277	275.9	24.1
38	37.9	03.3	98	97.6	08.5	158	157.4	13.8	218	217.2	19.0	278	276.9	24.2
39	38.9	03.4	99	98.6	08.6	159	158.4	13.9	219	218.2	19.1	279	277.9	24.3
40	39.8	03.5	100	99.6	08.7	160	159.4	13.9	220	219.2	19.2	280	278.9	24.4
41	40.8	03.6	101	100.6	08.8	161	160.4	14.0	221	220.2	19.3	281	279.9	24.5
42	41.8	03.7	102	101.6	08.9	162	161.4	14.1	222	221.2	19.3	282	280.9	24.6
43	42.8	03.7	103	102.6	09.0	163	162.4	14.2	223	222.2	19.4	283	281.9	24.7
44	43.8	03.8	104	103.6	09.1	164	163.4	14.3	224	223.1	19.5	284	282.9	24.8
45	44.8	03.9	105	104.6	09.2	165	164.4	14.4	225	224.1	19.6	285	283.9	24.8
46	45.8	04.0	106	105.6	09.2	166	165.4	14.5	226	225.1	19.7	286	284.9	24.9
47	46.8	04.1	107	106.6	09.3	167	166.4	14.6	227	226.1	19.8	287	285.9	25.0
48	47.8	04.2	108	107.6	09.4	168	167.4	14.6	228	227.1	19.9	288	286.9	25.1
49	48.8	04.3	109	108.6	09.5	169	168.4	14.7	229	228.1	20.0	289	287.9	25.2
50	49.8	04.4	110	109.6	09.6	170	169.4	14.8	230	229.1	20.0	290	288.9	25.3
51	50.8	04.4	111	110.6	09.7	171	170.3	14.9	231	230.1	20.1	291	289.9	25.4
52	51.8	04.5	112	111.6	09.8	172	171.3	15.0	232	231.1	20.2	292	290.9	25.4
53	52.8	04.6	113	112.6	09.8	173	172.3	15.1	233	232.1	20.3	293	291.9	25.5
54	53.8	04.7	114	113.6	09.9	174	173.3	15.2	234	233.1	20.4	294	292.9	25.6
55	54.8	04.8	115	114.6	10.0	175	174.3	15.3	235	234.1	20.5	295	293.9	25.7
56	55.8	04.9	116	115.6	10.1	176	175.3	15.3	236	235.1	20.6	296	294.9	25.8
57	56.8	05.0	117	116.6	10.2	177	176.3	15.4	237	236.1	20.7	297	295.9	25.9
58	57.8	05.1	118	117.6	10.3	178	177.3	15.5	238	237.1	20.7	298	296.9	26.0
59	58.8	05.1	119	118.5	10.4	179	178.3	15.6	239	238.1	20.8	299	297.9	26.1
60	59.8	05.2	120	119.5	10.5	180	179.3	15.7	240	239.1	20.9	300	298.9	26.1
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 85 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 6 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.1	61	60.7	06.4	121	120.3	12.6	181	180.0	18.9	241	239.7	25.2
2	02.0	00.2	62	61.7	06.5	122	121.3	12.8	182	181.0	19.0	242	240.7	25.3
3	03.0	00.3	63	62.7	06.6	123	122.3	12.9	183	182.0	19.1	243	241.7	25.4
4	04.0	00.4	64	63.6	06.7	124	123.3	13.0	184	183.0	19.2	244	242.7	25.5
5	05.0	00.5	65	64.6	06.8	125	124.3	13.1	185	184.0	19.3	245	243.7	25.6
6	06.0	00.6	66	65.6	06.9	126	125.3	13.2	186	185.0	19.4	246	244.7	25.7
7	07.0	00.7	67	66.6	07.0	127	126.3	13.3	187	186.0	19.5	247	245.6	25.8
8	08.0	00.8	68	67.6	07.1	128	127.3	13.4	188	187.0	19.7	248	246.6	25.9
9	09.0	00.9	69	68.6	07.2	129	128.3	13.5	189	188.0	19.8	249	247.6	26.0
10	09.9	01.0	70	69.6	07.3	130	129.3	13.6	190	189.0	19.9	250	248.6	26.1
11	10.9	01.1	71	70.6	07.4	131	130.3	13.7	191	190.0	20.0	251	249.6	26.2
12	11.9	01.3	72	71.6	07.5	132	131.3	13.8	192	190.9	20.1	252	250.6	26.3
13	12.9	01.4	73	72.6	07.6	133	132.3	13.9	193	191.9	20.2	253	251.6	26.4
14	13.9	01.5	74	73.6	07.7	134	133.3	14.0	194	192.9	20.3	254	252.6	26.6
15	14.9	01.6	75	74.6	07.8	135	134.3	14.1	195	193.9	20.4	255	253.6	26.7
16	15.9	01.7	76	75.6	07.9	136	135.3	14.2	196	194.9	20.5	256	254.6	26.8
17	16.9	01.8	77	76.6	08.0	137	136.2	14.3	197	195.9	20.6	257	255.6	26.9
18	17.9	01.9	78	77.6	08.2	138	137.2	14.4	198	196.9	20.7	258	256.6	27.0
19	18.9	02.0	79	78.6	08.3	139	138.2	14.5	199	197.9	20.8	259	257.6	27.1
20	19.9	02.1	80	79.6	08.4	140	139.2	14.6	200	198.9	20.9	260	258.6	27.2
21	20.9	02.2	81	80.6	08.5	141	140.2	14.7	201	199.9	21.0	261	259.6	27.3
22	21.9	02.3	82	81.6	08.6	142	141.2	14.8	202	200.9	21.1	262	260.6	27.4
23	22.9	02.4	83	82.5	08.7	143	142.2	14.9	203	201.9	21.2	263	261.6	27.5
24	23.9	02.5	84	83.5	08.8	144	143.2	15.1	204	202.9	21.3	264	262.6	27.6
25	24.9	02.6	85	84.5	08.9	145	144.2	15.2	205	203.9	21.4	265	263.5	27.7
26	25.9	02.7	86	85.5	09.0	146	145.2	15.3	206	204.9	21.5	266	264.5	27.8
27	26.9	02.8	87	86.5	09.1	147	146.2	15.4	207	205.9	21.6	267	265.5	27.9
28	27.8	02.9	88	87.5	09.2	148	147.2	15.5	208	206.9	21.7	268	266.5	28.0
29	28.8	03.0	89	88.5	09.3	149	148.2	15.6	209	207.9	21.8	269	267.5	28.1
30	29.8	03.1	90	89.5	09.4	150	149.2	15.7	210	208.8	22.0	270	268.5	28.2
31	30.8	03.2	91	90.5	09.5	151	150.2	15.8	211	209.8	22.1	271	269.5	28.3
32	31.8	03.3	92	91.5	09.6	152	151.2	15.9	212	210.8	22.2	272	270.5	28.4
33	32.8	03.4	93	92.5	09.7	153	152.2	16.0	213	211.8	22.3	273	271.5	28.5
34	33.8	03.6	94	93.5	09.8	154	153.2	16.1	214	212.8	22.4	274	272.5	28.6
35	34.8	03.7	95	94.5	09.9	155	154.2	16.2	215	213.8	22.5	275	273.5	28.7
36	35.8	03.8	96	95.5	10.0	156	155.1	16.3	216	214.8	22.6	276	274.5	28.8
37	36.8	03.9	97	96.5	10.1	157	156.1	16.4	217	215.8	22.7	277	275.5	29.0
38	37.8	04.0	98	97.5	10.2	158	157.1	16.5	218	216.8	22.8	278	276.5	29.1
39	38.8	04.1	99	98.5	10.3	159	158.1	16.6	219	217.8	22.9	279	277.5	29.2
40	39.8	04.2	100	99.5	10.5	160	159.1	16.7	220	218.8	23.0	280	278.5	29.3
41	40.8	04.3	101	100.4	10.6	161	160.1	16.8	221	219.8	23.1	281	279.5	29.4
42	41.8	04.4	102	101.4	10.7	162	161.1	16.9	222	220.8	23.2	282	280.5	29.5
43	42.8	04.5	103	102.4	10.8	163	162.1	17.0	223	221.8	23.3	283	281.4	29.6
44	43.8	04.6	104	103.4	10.9	164	163.1	17.1	224	222.8	23.4	284	282.4	29.7
45	44.8	04.7	105	104.4	11.0	165	164.1	17.2	225	223.8	23.5	285	283.4	29.8
46	45.7	04.8	106	105.4	11.1	166	165.1	17.4	226	224.8	23.6	286	284.4	29.9
47	46.7	04.9	107	106.4	11.2	167	166.1	17.5	227	225.8	23.7	287	285.4	30.0
48	47.7	05.0	108	107.4	11.3	168	167.1	17.6	228	226.8	23.8	288	286.4	30.1
49	48.7	05.1	109	108.4	11.4	169	168.1	17.7	229	227.7	23.9	289	287.4	30.2
50	49.7	05.2	110	109.4	11.5	170	169.1	17.8	230	228.7	24.0	290	288.4	30.3
51	50.7	05.3	111	110.4	11.6	171	170.1	17.9	231	229.7	24.1	291	289.4	30.4
52	51.7	05.4	112	111.4	11.7	172	171.1	18.0	232	230.7	24.3	292	290.4	30.5
53	52.7	05.5	113	112.4	11.8	173	172.1	18.1	233	231.7	24.4	293	291.4	30.6
54	53.7	05.6	114	113.4	11.9	174	173.0	18.2	234	232.7	24.5	294	292.4	30.7
55	54.7	05.7	115	114.4	12.0	175	174.0	18.3	235	233.7	24.6	295	293.4	30.8
56	55.7	05.9	116	115.4	12.1	176	175.0	18.4	236	234.7	24.7	296	294.4	30.9
57	56.7	06.0	117	116.4	12.2	177	176.0	18.5	237	235.7	24.8	297	295.4	31.0
58	57.7	06.1	118	117.4	12.3	178	177.0	18.6	238	236.7	24.9	298	296.4	31.1
59	58.7	06.2	119	118.3	12.4	179	178.0	18.7	239	237.7	25.0	299	297.4	31.3
60	59.7	06.3	120	119.3	12.5	180	179.0	18.8	240	238.7	25.1	300	298.4	31.4
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 84 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 7 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.1	61	60.5	07.4	121	120.1	14.7	181	179.7	22.1	241	239.2	29.4
2	02.0	00.2	62	61.5	07.6	122	121.1	14.9	182	180.6	22.2	242	240.2	29.5
3	03.0	00.4	63	62.5	07.7	123	122.1	15.0	183	181.6	22.3	243	241.2	29.6
4	04.0	00.5	64	63.5	07.8	124	123.1	15.1	184	182.6	22.4	244	242.2	29.7
5	05.0	00.6	65	64.5	07.9	125	124.1	15.2	185	183.6	22.5	245	243.2	29.9
6	06.0	00.7	66	65.5	08.0	126	125.1	15.4	186	184.6	22.7	246	244.2	30.0
7	06.9	00.9	67	66.5	08.2	127	126.1	15.5	187	185.6	22.8	247	245.2	30.1
8	07.9	01.0	68	67.5	08.3	128	127.0	15.6	188	186.6	22.9	248	246.2	30.2
9	08.9	01.1	69	68.5	08.4	129	128.0	15.7	189	187.6	23.0	249	247.1	30.3
10	09.9	01.2	70	69.5	08.5	130	129.0	15.8	190	188.6	23.2	250	248.1	30.5
11	10.9	01.3	71	70.5	08.7	131	130.0	16.0	191	189.6	23.3	251	249.1	30.6
12	11.9	01.5	72	71.5	08.8	132	131.0	16.1	192	190.6	23.4	252	250.1	30.7
13	12.9	01.6	73	72.5	08.9	133	132.0	16.2	193	191.6	23.5	253	251.1	30.8
14	13.9	01.7	74	73.4	09.0	134	133.0	16.3	194	192.6	23.6	254	252.1	31.0
15	14.9	01.8	75	74.4	09.1	135	134.0	16.5	195	193.5	23.8	255	253.1	31.1
16	15.9	01.9	76	75.4	09.3	136	135.0	16.6	196	194.5	23.9	256	254.1	31.2
17	16.9	02.1	77	76.4	09.4	137	136.0	16.7	197	195.5	24.0	257	255.1	31.3
18	17.9	02.2	78	77.4	09.5	138	137.0	16.8	198	196.5	24.1	258	256.1	31.4
19	18.9	02.3	79	78.4	09.6	139	138.0	16.9	199	197.5	24.3	259	257.1	31.6
20	19.9	02.4	80	79.4	09.7	140	139.0	17.1	200	198.5	24.4	260	258.1	31.7
21	20.8	02.6	81	80.4	09.9	141	139.9	17.2	201	199.5	24.5	261	259.1	31.8
22	21.8	02.7	82	81.4	10.0	142	140.9	17.3	202	200.5	24.6	262	260.0	31.9
23	22.8	02.8	83	82.4	10.1	143	141.9	17.4	203	201.5	24.7	263	261.0	32.1
24	23.8	02.9	84	83.4	10.2	144	142.9	17.5	204	202.5	24.9	264	262.0	32.2
25	24.8	03.0	85	84.4	10.4	145	143.9	17.7	205	203.5	25.0	265	263.0	32.3
26	25.8	03.2	86	85.4	10.5	146	144.9	17.8	206	204.5	25.1	266	264.0	32.4
27	26.8	03.3	87	86.4	10.6	147	145.9	17.9	207	205.5	25.2	267	265.0	32.5
28	27.8	03.4	88	87.3	10.7	148	146.9	18.0	208	206.4	25.3	268	266.0	32.7
29	28.8	03.5	89	88.3	10.8	149	147.9	18.2	209	207.4	25.5	269	267.0	32.8
30	29.8	03.7	90	89.3	11.0	150	148.9	18.3	210	208.4	25.6	270	268.0	32.9
31	30.8	03.8	91	90.3	11.1	151	149.9	18.4	211	209.4	25.7	271	269.0	33.0
32	31.8	03.9	92	91.3	11.2	152	150.9	18.5	212	210.4	25.8	272	270.0	33.1
33	32.8	04.0	93	92.3	11.3	153	151.9	18.6	213	211.4	26.0	273	271.0	33.3
34	33.7	04.1	94	93.3	11.5	154	152.9	18.8	214	212.4	26.1	274	272.0	33.4
35	34.7	04.3	95	94.3	11.6	155	153.8	18.9	215	213.4	26.2	275	273.0	33.5
36	35.7	04.4	96	95.3	11.7	156	154.8	19.0	216	214.4	26.3	276	273.9	33.6
37	36.7	04.5	97	96.3	11.8	157	155.8	19.1	217	215.4	26.4	277	274.9	33.8
38	37.7	04.6	98	97.3	11.9	158	156.8	19.3	218	216.4	26.6	278	275.9	33.9
39	38.7	04.8	99	98.3	12.1	159	157.8	19.4	219	217.4	26.7	279	276.9	34.0
40	39.7	04.9	100	99.3	12.2	160	158.8	19.5	220	218.4	26.8	280	277.9	34.1
41	40.7	05.0	101	100.2	12.3	161	159.8	19.6	221	219.4	26.9	281	278.9	34.2
42	41.7	05.1	102	101.2	12.4	162	160.8	19.7	222	220.3	27.1	282	279.9	34.4
43	42.7	05.2	103	102.2	12.6	163	161.8	19.9	223	221.3	27.2	283	280.9	34.5
44	43.7	05.4	104	103.2	12.7	164	162.8	20.0	224	222.3	27.3	284	281.9	34.6
45	44.7	05.5	105	104.2	12.8	165	163.8	20.1	225	223.3	27.4	285	282.9	34.7
46	45.7	05.6	106	105.2	12.9	166	164.8	20.2	226	224.3	27.5	286	283.9	34.9
47	46.6	05.7	107	106.2	13.0	167	165.8	20.4	227	225.3	27.7	287	284.9	35.0
48	47.6	05.8	108	107.2	13.2	168	166.7	20.5	228	226.3	27.8	288	285.9	35.1
49	48.6	06.0	109	108.2	13.3	169	167.7	20.6	229	227.3	27.9	289	286.8	35.2
50	49.6	06.1	110	109.2	13.4	170	168.7	20.7	230	228.3	28.0	290	287.8	35.3
51	50.6	06.2	111	110.2	13.5	171	169.7	20.8	231	229.3	28.2	291	288.8	35.5
52	51.6	06.3	112	111.2	13.6	172	170.7	21.0	232	230.3	28.3	292	289.8	35.6
53	52.6	06.5	113	112.2	13.8	173	171.7	21.1	233	231.3	28.4	293	290.8	35.7
54	53.6	06.6	114	113.2	13.9	174	172.7	21.2	234	232.3	28.5	294	291.8	35.8
55	54.6	06.7	115	114.1	14.0	175	173.7	21.3	235	233.2	28.6	295	292.8	36.0
56	55.6	06.8	116	115.1	14.1	176	174.7	21.4	236	234.2	28.8	296	293.8	36.1
57	56.6	06.9	117	116.1	14.3	177	175.7	21.6	237	235.2	28.9	297	294.8	36.2
58	57.6	07.1	118	117.1	14.4	178	176.7	21.7	238	236.2	29.0	298	295.8	36.3
59	58.6	07.2	119	118.1	14.5	179	177.7	21.8	239	237.2	29.1	299	296.8	36.4
60	59.6	07.3	120	119.1	14.6	180	178.7	21.9	240	238.2	29.2	300	297.8	36.6
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 83 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 8 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.1	61	60.4	08.5	121	119.8	16.8	181	179.2	25.2	241	238.7	33.5
2	02.0	00.3	62	61.4	08.6	122	120.8	17.0	182	180.2	25.3	242	239.6	33.7
3	03.0	00.4	63	62.4	08.8	123	121.8	17.1	183	181.2	25.5	243	240.6	33.8
4	04.0	00.6	64	63.4	08.9	124	122.8	17.3	184	182.2	25.6	244	241.6	34.0
5	05.0	00.7	65	64.4	09.0	125	123.8	17.4	185	183.2	25.7	245	242.6	34.1
6	05.9	00.8	66	65.4	09.2	126	124.8	17.5	186	184.2	25.9	246	243.6	34.2
7	06.9	01.0	67	66.3	09.3	127	125.8	17.7	187	185.2	26.0	247	244.6	34.4
8	07.9	01.1	68	67.3	09.5	128	126.8	17.8	188	186.2	26.2	248	245.6	34.5
9	08.9	01.3	69	68.3	09.6	129	127.7	18.0	189	187.2	26.3	249	246.6	34.7
10	09.9	01.4	70	69.3	09.7	130	128.7	18.1	190	188.2	26.4	250	247.6	34.8
11	10.9	01.5	71	70.3	09.9	131	129.7	18.2	191	189.1	26.6	251	248.6	34.9
12	11.9	01.7	72	71.3	10.0	132	130.7	18.4	192	190.1	26.7	252	249.5	35.1
13	12.9	01.8	73	72.3	10.2	133	131.7	18.5	193	191.1	26.9	253	250.5	35.2
14	13.9	01.9	74	73.3	10.3	134	132.7	18.6	194	192.1	27.0	254	251.5	35.3
15	14.8	02.1	75	74.3	10.4	135	133.7	18.8	195	193.1	27.1	255	252.5	35.5
16	15.8	02.2	76	75.3	10.6	136	134.7	18.9	196	194.1	27.3	256	253.5	35.6
17	16.8	02.4	77	76.3	10.7	137	135.7	19.1	197	195.1	27.4	257	254.5	35.8
18	17.8	02.5	78	77.2	10.9	138	136.7	19.2	198	196.1	27.6	258	255.5	35.9
19	18.8	02.6	79	78.2	11.0	139	137.7	19.3	199	197.1	27.7	259	256.5	36.0
20	19.8	02.8	80	79.2	11.1	140	138.6	19.5	200	198.1	27.8	260	257.5	36.2
21	20.8	02.9	81	80.2	11.3	141	139.6	19.6	201	199.0	28.0	261	258.5	36.3
22	21.8	03.1	82	81.2	11.4	142	140.6	19.8	202	200.0	28.1	262	259.5	36.5
23	22.8	03.2	83	82.2	11.6	143	141.6	19.9	203	201.0	28.3	263	260.4	36.6
24	23.8	03.3	84	83.2	11.7	144	142.6	20.0	204	202.0	28.4	264	261.4	36.7
25	24.8	03.5	85	84.2	11.8	145	143.6	20.2	205	203.0	28.5	265	262.4	36.9
26	25.7	03.6	86	85.2	12.0	146	144.6	20.3	206	204.0	28.7	266	263.4	37.0
27	26.7	03.8	87	86.2	12.1	147	145.6	20.5	207	205.0	28.8	267	264.4	37.2
28	27.7	03.9	88	87.1	12.2	148	146.6	20.6	208	206.0	28.9	268	265.4	37.3
29	28.7	04.0	89	88.1	12.4	149	147.5	20.7	209	207.0	29.1	269	266.4	37.4
30	29.7	04.2	90	89.1	12.5	150	148.5	20.9	210	208.0	29.2	270	267.4	37.6
31	30.7	04.3	91	90.1	12.7	151	149.5	21.0	211	208.9	29.4	271	268.4	37.7
32	31.7	04.5	92	91.1	12.8	152	150.5	21.2	212	209.9	29.5	272	269.4	37.9
33	32.7	04.6	93	92.1	12.9	153	151.5	21.3	213	210.9	29.6	273	270.3	38.0
34	33.7	04.7	94	93.1	13.1	154	152.5	21.4	214	211.9	29.8	274	271.3	38.1
35	34.7	04.9	95	94.1	13.2	155	153.5	21.6	215	212.9	29.9	275	272.3	38.3
36	35.6	05.0	96	95.1	13.4	156	154.5	21.7	216	213.9	30.1	276	273.3	38.4
37	36.6	05.1	97	96.1	13.5	157	155.5	21.9	217	214.9	30.2	277	274.3	38.6
38	37.6	05.3	98	97.0	13.6	158	156.5	22.0	218	215.9	30.3	278	275.3	38.7
39	38.6	05.4	99	98.0	13.8	159	157.5	22.1	219	216.9	30.5	279	276.3	38.8
40	39.6	05.6	100	99.0	13.9	160	158.4	22.3	220	217.9	30.6	280	277.3	39.0
41	40.6	05.7	101	100.0	14.1	161	159.4	22.4	221	218.8	30.8	281	278.3	39.1
42	41.6	05.8	102	101.0	14.2	162	160.4	22.5	222	219.8	30.9	282	279.3	39.2
43	42.6	06.0	103	102.0	14.3	163	161.4	22.7	223	220.8	31.0	283	280.2	39.4
44	43.6	06.1	104	103.0	14.5	164	162.4	22.8	224	221.8	31.2	284	281.2	39.5
45	44.6	06.3	105	104.0	14.6	165	163.4	23.0	225	222.8	31.3	285	282.2	39.7
46	45.6	06.4	106	105.0	14.8	166	164.4	23.1	226	223.8	31.5	286	283.2	39.8
47	46.5	06.5	107	106.0	14.9	167	165.4	23.2	227	224.8	31.6	287	284.2	39.9
48	47.5	06.7	108	106.9	15.0	168	166.4	23.4	228	225.8	31.7	288	285.2	40.1
49	48.5	06.8	109	107.9	15.2	169	167.4	23.5	229	226.8	31.9	289	286.2	40.2
50	49.5	07.0	110	108.9	15.3	170	168.3	23.7	230	227.8	32.0	290	287.2	40.4
51	50.5	07.1	111	109.9	15.4	171	169.3	23.8	231	228.8	32.1	291	288.2	40.5
52	51.5	07.2	112	110.9	15.6	172	170.3	23.9	232	229.7	32.3	292	289.2	40.6
53	52.5	07.4	113	111.9	15.7	173	171.3	24.1	233	230.7	32.4	293	290.1	40.8
54	53.5	07.5	114	112.9	15.9	174	172.3	24.2	234	231.7	32.6	294	291.1	40.9
55	54.5	07.7	115	113.9	16.0	175	173.3	24.4	235	232.7	32.7	295	292.1	41.1
56	55.5	07.8	116	114.9	16.1	176	174.3	24.5	236	233.7	32.8	296	293.1	41.2
57	56.4	07.9	117	115.9	16.3	177	175.3	24.6	237	234.7	33.0	297	294.1	41.3
58	57.4	08.1	118	116.9	16.4	178	176.3	24.8	238	235.7	33.1	298	295.1	41.5
59	58.4	08.2	119	117.8	16.6	179	177.3	24.9	239	236.7	33.3	299	296.1	41.6
60	59.4	08.4	120	118.8	16.7	180	178.2	25.1	240	237.7	33.4	300	297.1	41.8
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 82 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 9 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.2	61	60.2	09.5	121	119.5	18.9	181	178.8	28.3	241	238.0	37.7
2	02.0	00.3	62	61.2	09.7	122	120.5	19.1	182	179.8	28.5	242	239.0	37.9
3	03.0	00.5	63	62.2	09.9	123	121.5	19.2	183	180.7	28.6	243	240.0	38.0
4	04.0	00.6	64	63.2	10.0	124	122.5	19.4	184	181.7	28.8	244	241.0	38.2
5	04.9	00.8	65	64.2	10.2	125	123.5	19.6	185	182.7	28.9	245	242.0	38.3
6	05.9	00.9	66	65.2	10.3	126	124.4	19.7	186	183.7	29.1	246	243.0	38.5
7	06.9	01.1	67	66.2	10.5	127	125.4	19.9	187	184.7	29.3	247	244.0	38.6
8	07.9	01.3	68	67.2	10.6	128	126.4	20.0	188	185.7	29.4	248	244.9	38.8
9	08.9	01.4	69	68.2	10.8	129	127.4	20.2	189	186.7	29.6	249	245.9	39.0
10	09.9	01.6	70	69.1	11.0	130	128.4	20.3	190	187.7	29.7	250	246.9	39 1
11	10.9	01.7	71	70.1	11.1	131	129.4	20.5	191	188.6	29.9	251	247.9	39.3
12	11.9	01.9	72	71.1	11.3	132	130.4	20.6	192	189.6	30.0	252	248.9	39.4
13	12.8	02.0	73	72.1	11.4	133	131.4	20.8	193	190.6	30.2	253	249.9	39.6
14	13.8	02.2	74	73.1	11.6	134	132.4	21.0	194	191.6	30.3	254	250.9	39.7
15	14.8	02.3	75	74.1	11.7	135	133.3	21.1	195	192.6	30.5	255	251.9	39.9
16	15.8	02.5	76	75.1	11.9	136	134.3	21.3	196	193.6	30.7	256	252.8	40.0
17	16.8	02.7	77	76.1	12.0	137	135.3	21.4	197	194.6	30.8	257	253.8	40 2
18	17.8	02.8	78	77.0	12.2	138	136.3	21.6	198	195.6	31.0	258	254.8	40.4
19	18 8	03.0	79	78.0	12.4	139	137.3	21.7	199	196.5	31.1	259	255.8	40.5
20	19.8	03.1	80	79.0	12.5	140	138.3	21.9	200	197.5	31.3	260	256.8	40.7
21	20.7	03.3	81	80.0	12.7	141	139.3	22.1	201	198.5	31.4	261	257.8	40.8
22	21.7	03 4	82	81.0	12.8	142	140.3	22.2	202	199.5	31.6	262	258.8	41.0
23	22.7	03.6	83	82.0	13.0	143	141.2	22.4	203	200.5	31.8	263	259.8	41.1
24	23.7	03.8	84	83.0	13.1	144	142.2	22.5	204	201.5	31.9	264	260.7	41.3
25	24.7	03.9	85	84.0	13.3	145	143.2	22.7	205	202.5	32.1	265	261.7	41.5
26	25.7	04.1	86	84.9	13.5	146	144.2	22.8	206	203.5	32.2	266	262.7	41.6
27	26.7	04.2	87	85.9	13.6	147	145.2	23.0	207	204.5	32.4	267	263.7	41 8
28	27.7	04.4	88	86.9	13.8	148	146.2	23.2	208	205.4	32.5	268	264.7	41 9
29	28.6	04.5	89	87.9	13.9	149	147 2	23.3	209	206.4	32.7	269	265.7	42.1
30	29.6	04.7	90	88.9	14.1	150	148.2	23.5	210	207.4	32.9	270	266.7	42.2
31	30.6	04.8	91	89.9	14.2	151	149.1	23.6	211	208.4	33.0	271	267.7	42.4
32	31.6	05.0	92	90.9	14.4	152	150.1	23.8	212	209.4	33.2	272	268.7	42.6
33	32.6	05.2	93	91.9	14.5	153	151.1	23.9	213	210.4	33.3	273	269.7	42.7
34	33.6	05.3	94	92.8	14.7	154	152.1	24.1	214	211.4	33.5	274	270.6	42 9
35	34.6	05.5	95	93.8	14.9	155	153.1	24.2	215	212.4	33.6	275	271.6	43.0
36	35.6	05.6	96	94.8	15.0	156	154.1	24.4	216	213.3	33.8	276	272.6	43.2
37	36.5	05.8	97	95.8	15.2	157	155.1	24.6	217	214.3	33.9	277	273.6	43 3
38	37.5	05.9	98	96.8	15.3	158	156.1	24.7	218	215.3	34.1	278	274.6	43.5
39	38.5	06 1	99	97.8	15.5	159	157.0	24.9	219	216.3	34.3	279	275.6	43.6
40	39 5	06.3	100	98.8	15.6	160	158.0	25.0	220	217.3	34.4	280	276.6	43 8
41	40.5	06.4	101	99.8	15.8	161	159.0	25.2	221	218.3	34.6	281	277.5	44 0
42	41.5	06 6	102	100.7	16.0	162	160.0	25.3	222	219.3	34.7	282	278.5	44.1
43	42.5	06.7	103	101.7	16.1	163	161.0	25.5	223	220.3	34.9	283	279.5	44 3
44	43.5	06.9	104	102.7	16.3	164	162.0	25.7	224	221.2	35.0	284	280.5	44.4
45	44.4	07.0	105	103.7	16.4	165	163.0	25.8	225	222.2	35 2	285	281.5	44 6
46	45.4	07.2	106	104.7	16.6	166	164.0	26.0	226	223.2	35.4	286	282.5	44.7
47	46.4	07.4	107	105.7	16.7	167	164 9	26.1	227	224.2	35.5	287	283.5	44.9
48	47.4	07.5	108	106.7	16.9	168	165.9	26.3	228	225.2	35.7	288	284.5	45.1
49	48.4	07.7	109	107.7	17.1	169	166.9	26.4	229	226.2	35.8	289	285.4	45.2
50	49.4	07.8	110	108.6	17.2	170	167.9	26.6	230	227.2	36.0	290	286.4	45.4
51	50.4	08.0	111	109.6	17.4	171	168.9	26.8	231	228.2	36.1	291	287.4	45.5
52	51.4	08.1	112	110.6	17.5	172	169.9	26.9	232	229.1	36.3	292	288.4	45.7
53	52.3	08.3	113	111.6	17.7	173	170.9	27.1	233	230.1	36.4	293	289.4	45.8
54	53.3	08.4	114	112.6	17.8	174	171.9	27.2	234	231.1	36.6	294	290.4	46.0
55	54.3	08.6	115	113.6	18.0	175	172.8	27.4	235	232.1	36.8	295	291.4	46.1
56	55.3	08.8	116	114.6	18.1	176	173.8	27.5	236	233.1	36.9	296	292.4	46.3
57	56.3	08.9	117	115.6	18.3	177	174.8	27.7	237	234.1	37.1	297	293.4	46.5
58	57.3	09.1	118	116.5	18 5	178	175.8	27.8	238	235.1	37.2	298	294.3	46.6
59	58.3	09.2	119	117.5	18.6	179	176.8	28.0	239	236.1	37.4	299	295.3	46.8
60	59.3	09.4	120	118.5	18.8	180	177.8	28.2	240	237.0	37.5	300	296.3	46.9
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 81 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 10 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.2	61	60.1	10.6	121	119.2	21.0	181	178.3	31.4	241	237.3	41.8
2	02.0	00.3	62	61.1	10.8	122	120.1	21.2	182	179.2	31.6	242	238.3	42.0
3	03.0	00.5	63	62.0	10.9	123	121.1	21.4	183	180.2	31.8	243	239.3	42.2
4	03.9	00.7	64	63.0	11.1	124	122.1	21.5	184	181.2	32.0	244	240.3	42.4
5	04.9	00.9	65	64.0	11.3	125	123.1	21.7	185	182.2	32.1	245	241.3	42 5
6	05.9	01.0	66	65.0	11.5	126	124.1	21.9	186	183.2	32.3	246	242.3	42.7
7	06.9	01.2	67	66.0	11.6	127	125.1	22.1	187	184.2	32.5	247	243.2	42.9
8	07.9	01.4	68	67.0	11.8	128	126.1	22.2	188	185.1	32.6	248	244.2	43.1
9	08.9	01.6	69	68.0	12.0	129	127.0	22.4	189	186.1	32.8	249	245.2	43.2
10	09.8	01.7	70	68.9	12.2	130	128.0	22.6	190	187.1	33.0	250	246.2	43.4
11	10.8	01.9	71	69.9	12.3	131	129 0	22.7	191	188.1	33 2	251	247.2	43.6
12	11.8	02.1	72	70.9	12.5	132	130.0	22.9	192	189.1	33.3	252	248.2	43.8
13	12.8	02.3	73	71.9	12.7	133	131.0	23.1	193	190.1	33.5	253	249.2	43.9
14	13.8	02.4	74	72.9	12.8	134	132.0	23 3	194	191.0	33.7	254	250.1	44.1
15	14.8	02.6	75	73.9	13.0	135	132.9	23.4	195	192.0	33.9	255	251 1	44.3
16	15.8	02.8	76	74.8	13.2	136	133.9	23.6	196	193.0	34.0	256	252.1	44.5
17	16.7	03.0	77	75.8	13.4	137	134.9	23.8	197	194.0	34.2	257	253.1	41.6
18	17.7	03.1	78	76.8	13.5	138	135.9	24.0	198	195.0	34.4	258	254.1	44.8
19	18.7	03.3	79	77.8	13.7	139	136.9	24.1	199	196.0	34.6	259	255.1	45.0
20	19.7	03.5	80	78.8	13.9	140	137.9	24.3	200	197.0	34.7	260	256.1	45 1
21	20.7	03.6	81	79.8	14.1	141	138.9	24.5	201	197.9	34.9	261	257.0	45.3
22	21 7	03 8	82	80.8	14.2	142	139.8	24.7	202	198.9	35.1	262	258.0	45.5
23	22.7	04.0	83	81.7	14.4	143	140.8	24.8	203	199.9	35.3	263	259.0	45.7
24	23.6	04.2	84	82.7	14 6	144	141.8	25.0	204	200.9	35.4	264	260.0	45.8
25	24.6	04.3	85	83.7	14.8	145	142.8	25.2	205	201.9	35.6	265	261.0	46.0
26	25.6	04.5	86	84.7	14.9	146	143.8	25.4	206	202.9	35.8	266	262.0	46.2
27	26.6	04.7	87	85.7	15.1	147	144.8	25.5	207	203.9	35.9	267	262.9	46.4
28	27.6	04.9	88	86.7	15.3	148	145.8	25.7	208	204.8	36.1	268	263.9	46.5
29	28.6	05.0	89	87.6	15 5	149	146.7	25.9	209	205.8	36.3	269	264.9	46.7
30	29.5	05.2	90	88.6	15.6	150	147.7	26.0	210	206.8	36.5	270	265.9	46.9
31	30.5	05.4	91	89.6	15.8	151	148.7	26.2	211	207.8	36.6	271	266.9	47.1
32	31.5	05.6	92	90.6	16.0	152	149.7	26.4	212	208.8	36.8	272	267.9	47.2
33	32.5	05.7	93	91.6	16.1	153	150.7	26.6	213	209.8	37.0	273	268.9	47.4
34	33.5	05.9	94	92.6	16.3	154	151.7	26.7	214	210 7	37.2	274	269.8	47.6
35	34.5	06.1	95	93.6	16.5	155	152.6	26.9	215	211.7	37.3	275	270.8	47.8
36	35.5	06.3	96	94.5	16.7	156	153.6	27.1	216	212.7	37.5	276	271.8	47.9
37	36.4	06.4	97	95.5	16.8	157	154.6	27 3	217	213.7	37.7	277	272.8	48.1
38	37.4	06.6	98	96.5	17.0	158	155.6	27.4	218	214.7	37.9	278	273.8	48.3
39	38.4	06.8	99	97.5	17.2	159	156.6	27.6	219	215.7	38.0	279	274.8	48.4
40	39.4	06.9	100	98.5	17.4	160	157.6	27.8	220	216 7	38.2	280	275.7	48.6
41	40.4	07.1	101	99.5	17.5	161	158.6	28.0	221	217.6	38.4	281	276.7	48.8
42	41.4	07.3	102	100.5	17.7	162	159.5	28.1	222	218.6	38.5	282	277.7	49.0
43	42.3	07 5	103	101.4	17.9	163	160.5	28.3	223	219.6	38.7	283	278.7	49.1
44	43.3	07.6	104	102.4	18.1	164	161.5	28.5	224	220.6	38.9	284	279.7	49.3
45	44 3	07.8	105	103.4	18.2	165	162.5	28.7	225	221.6	39.1	285	280.7	49.5
46	45.3	08.0	106	104.4	18.4	166	163.5	28 8	226	222.6	39.2	286	281.7	49.7
47	46.3	08.2	107	105.4	18.6	167	164 5	29.0	227	223.6	39.4	287	282.6	49.8
48	47.3	08.3	108	106.4	18.8	168	165.4	29.2	228	224.5	39.6	288	283.6	50.0
49	48.3	08.5	109	107.3	18.9	169	166.4	29.3	229	225.5	39.8	289	284.6	50.2
50	49.2	08.7	110	108.3	19.1	170	167.4	29.5	230	226.5	39.9	290	285.6	50.4
51	50.2	08.9	111	109.3	19.3	171	168.4	29.7	231	227.5	40.1	291	286.6	50.5
52	51.2	09.0	112	110.3	19.4	172	169.4	29.9	232	228.5	40.3	292	287 6	50.7
53	52.2	09.2	113	111.3	19.6	173	170.4	30.0	233	229.5	40.5	293	288.5	50.9
54	53.2	09.4	114	112.3	19.8	174	171.4	30.2	234	230.4	40.6	294	289.5	51.1
55	54.2	09.6	115	113.3	20.0	175	172.3	30.4	235	231.4	40.8	295	290.5	51.2
56	55.1	09.7	116	114.2	20.1	176	173.3	30.6	236	232.4	41.0	296	291.5	51 4
57	56.1	09.9	117	115.2	20.3	177	174.3	30.7	237	233.4	41.2	297	292.5	51 6
58	57.1	10.1	118	116 2	20.5	178	175.3	30.9	238	234.4	41.3	298	293 5	51.7
59	58.1	10.2	119	117 2	20 7	179	176.3	31.1	239	235.4	41.5	299	294.5	51.9
60	59 1	10.4	120	118.2	20.8	180	177.3	31.3	240	236.4	41.7	300	295.4	52.1
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 80 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 11 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.2	61	59.9	11.6	121	118.8	23.1	181	177.7	34.5	241	236.6	46.0
2	02.0	00.4	62	60.9	11.8	122	119.8	23.3	182	178.7	34.7	242	237.6	46.2
3	02.9	00.6	63	61.8	12.0	123	120.7	23.5	183	179.6	34.9	243	238.5	46.4
4	03.9	00.8	64	62.8	12.2	124	121.7	23.7	184	180.6	35.1	244	239.5	46.6
5	04.9	01.0	65	63.8	12.4	125	122.7	23.9	185	181.6	35.3	215	240.5	46.7
6	05.9	01.1	66	64.8	12.6	126	123.7	24.0	186	182.6	35.5	246	241.5	46.9
7	06.9	01.3	67	65.8	12.8	127	124.7	24.2	187	183.6	35.7	247	242.5	47.1
8	07.9	01.5	68	66.8	13.0	128	125.6	24.4	188	184.5	35.9	248	243.4	47.3
9	08.8	01.7	69	67.7	13.2	129	126.6	24.6	189	185.5	36.1	249	244.4	47.5
10	09.8	01.9	70	68.7	13.4	130	127.6	24.8	190	186.5	36.3	250	245.4	47.7
11	10.8	02.1	71	69.7	13.5	131	128.6	25.0	191	187.5	36.4	251	246.4	47.9
12	11.8	02.3	72	70.7	13.7	132	129.6	25.2	192	188.5	36.6	252	247.4	48.1
13	12.8	02.5	73	71.7	13.9	133	130.6	25.4	193	189.5	36.8	253	248.4	48.3
14	13.7	02.7	74	72.6	14.1	134	131.5	25.6	194	190.4	37.0	254	249.3	48.5
15	14.7	02.9	75	73.6	14.3	135	132.5	25.8	195	191.4	37.2	255	250.3	48.7
16	15.7	03.1	76	74.6	14.5	136	133.5	26.0	196	192.4	37.4	256	251.3	48.8
17	16.7	03.2	77	75.6	14.7	137	134.5	26.1	197	193.4	37.6	257	252.3	49.0
18	17.7	03.4	78	76.6	14.9	138	135.5	26.3	198	194.4	37.8	258	253.3	49.2
19	18.7	03.6	79	77.5	15.1	139	136.4	26.5	199	195.3	38.0	259	254.2	49.4
20	19.6	03.8	80	78.5	15.3	140	137.4	26.7	200	196.3	38.2	260	255.2	49 6
21	20.6	04.0	81	79.5	15.5	141	138.4	26.9	201	197.3	38.4	261	256.2	49.8
22	21.6	04.2	82	80.5	15.6	142	139.4	27 1	202	198.3	38.5	262	257.2	50.0
23	22.6	04.4	83	81.5	15.8	143	140.4	27.3	203	199.3	38.7	263	258.2	50.2
24	23.6	04.6	84	82.5	16.0	144	141.4	27.5	204	200.3	38.9	264	259.1	50.4
25	24.5	04.8	85	83.4	16.2	145	142.3	27.7	205	201.2	39 1	265	260.1	50.6
26	25.5	05.0	86	84.4	16.4	146	143.3	27.9	206	202.2	39.3	266	261.1	50.8
27	26.5	05.2	87	85.4	16.6	147	144.3	28.0	207	203.2	39.5	267	262.1	50.9
28	27.5	05.3	88	86.4	16.8	148	145.3	28.2	208	204.2	39.7	268	263.1	51.1
29	28.5	05.5	89	87.4	17.0	149	146.3	28.4	209	205.2	39.9	269	264.1	51.3
30	29.4	05.7	90	88.3	17.2	150	147.2	28.6	210	206.1	40.1	270	265.0	51.5
31	30.4	05.9	91	89.3	17.4	151	148.2	28.8	211	207.1	40.3	271	266.0	51.7
32	31.4	06.1	92	90.3	17.6	152	149.2	29.0	212	208.1	40.5	272	267.0	51.9
33	32.4	06.3	93	91.3	17.7	153	150.2	29.2	213	209.1	40.6	273	268.0	52.1
34	33.4	06.5	94	92.3	17.9	154	151.2	29.4	214	210.1	40.8	274	269.0	52.3
35	34.4	06.7	95	93.3	18.1	155	152.2	29.6	215	211.0	41.0	275	269.9	52.5
36	35.3	06.9	96	94.2	18.3	156	153.1	29.8	216	212.0	41.2	276	270.9	52.7
37	36.3	07.1	97	95.2	18.5	157	154.1	30.0	217	213.0	41.4	277	271.9	52.9
38	37.3	07.3	98	96.2	18.7	158	155.1	30.1	218	214.0	41.6	278	272.9	53.0
39	38.3	07.4	99	97.2	18.9	159	156.1	30.3	219	215.0	41.8	279	273.9	53 2
40	39.3	07.6	100	98.2	19.1	160	157.1	30.5	220	216.0	42.0	280	274.9	53.4
41	40.2	07.8	101	99.1	19.3	161	158.0	30.7	221	216.9	42.2	281	275.8	53.6
42	41.2	08.0	102	100.1	19.5	162	159.0	30.9	222	217.9	42.4	282	276.8	53.8
43	12.2	08.2	103	101.1	19.7	163	160.0	31.1	223	218.9	42.6	283	277.8	54.0
44	43.2	08.4	104	102.1	19.8	164	161.0	31.3	224	219.9	42.7	284	278.8	54.2
45	44.2	08.6	105	103.1	20.0	165	162.0	31.5	225	220.9	42.9	285	279.8	54.4
46	45.2	08.8	106	104.1	20.2	166	163.0	31.7	226	221.8	43.1	286	280.7	54.6
47	46.1	09.0	107	105.0	20.4	167	163.9	31.9	227	222.8	43.3	287	281.7	54.8
48	47.1	09.2	108	106.0	20.6	168	164.9	32.1	228	223.8	43.5	288	282.7	55.0
49	48.1	09.3	109	107.0	20.8	169	165.9	32.2	229	224.8	43.7	289	283.7	55.1
50	49.1	09.5	110	108.0	21.0	170	166.9	32.4	230	225.8	43.9	290	284.7	55.3
51	50.1	09.7	111	109.0	21.2	171	167.9	32.6	231	226.8	44.1	291	285.7	55.5
52	51.0	09.9	112	109.9	21.4	172	168.8	32.8	232	227.7	44.3	292	286.6	55 7
53	52.0	10.1	113	110.9	21.6	173	169.8	33.0	233	228.7	44.5	293	287.6	55.9
54	53.0	10.3	114	111.9	21.8	174	170.8	33.2	234	229.7	44.6	294	288.6	56.1
55	54 0	10.5	115	112.9	21.9	175	171.8	33.4	235	230.7	44.8	295	289.6	56.3
56	55.0	10.7	116	113.9	22.1	176	172.8	33.6	236	231.7	45.0	296	290.6	56.5
57	56.0	10.9	117	114.9	22.3	177	173.7	33.8	237	232.6	45.2	297	291.5	56.7
58	56 9	11.1	118	115.8	22.5	178	174.7	34.0	238	233.6	45.4	298	292.5	56.9
59	57.9	11.3	119	116.8	22.7	179	175.7	34.2	239	234.6	45.6	299	293.5	57.1
60	58.9	11.4	120	117.8	22.9	180	176.7	34.3	240	235.6	45.8	300	294.5	57.2
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 79 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 12 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.2	61	59.7	12.7	121	118.4	25.2	181	177.0	37.6	241	235.7	50.1
2	02.0	00.4	62	60.6	12.9	122	119.3	25.4	182	178.0	37.8	242	236.7	50.3
3	02.9	00.6	63	61.6	13.1	123	120.3	25.6	183	179.0	38.0	243	237.7	50.5
4	03.9	00.8	64	62.6	13.3	124	121.3	25.8	184	180.0	38.3	244	238.7	50.7
5	04.9	01.0	65	63.6	13.5	125	122.3	26.0	185	181.0	38.5	245	239.6	50.9
6	05.9	01.2	66	64.6	13.7	126	123.2	26.2	186	181.9	38.7	246	240.6	51.1
7	06.8	01 5	67	65.5	13.9	127	124.2	26.4	187	182.9	38.9	247	241.6	51.4
8	07.8	01.7	68	66.5	14.1	128	125.2	26.6	188	183.9	39.1	248	242.6	51.6
9	08.8	01.9	69	67.5	14.3	129	126.2	26.8	189	184.9	39.3	249	243.6	51.8
10	09.8	02.1	70	68.5	14.6	130	127.2	27.0	190	185.8	39.5	250	244.5	52.0
11	10.8	02.3	71	69.4	14.8	131	128.1	27.2	191	186.8	39.7	251	245.5	52.2
12	11.7	02.5	72	70.4	15.0	132	129.1	27.4	192	187.8	39.9	252	246.5	52.4
13	12.7	02.7	73	71.4	15.2	133	130.1	27.7	193	188.8	40.1	253	247.5	52.6
14	13.7	02.9	74	72.4	15.4	134	131.1	27.9	194	189.8	40.3	254	248.4	52.8
15	14.7	03.1	75	73.4	15.6	135	132.0	28.1	195	190.7	40.5	255	249.4	53.0
16	15.7	03.3	76	74.3	15.8	136	133.0	28.3	196	191.7	40.8	256	250.4	53.2
17	16.6	03.5	77	75.3	16.0	137	134.0	28.5	197	192.7	41.0	257	251.4	53.4
18	17.6	03.7	78	76.3	16.2	138	135.0	28.7	198	193.7	41.2	258	252.4	53.6
19	18.6	04.0	79	77.3	16.4	139	136.0	28.9	199	194.7	41.4	259	253.3	53.8
20	19.6	04.2	80	78.3	16.6	140	136.9	29 1	200	195.6	41.6	260	254.3	54.1
21	20.5	04.4	81	79.2	16.8	141	137.9	29.3	201	196.6	41.8	261	255.3	54.3
22	21.5	04.6	82	80.2	17.0	142	138.9	29.5	202	197.6	42.0	262	256.3	54.5
23	22.5	04.8	83	81.2	17.3	143	139.9	29.7	203	198.6	42.2	263	257.3	54.7
24	23.5	05.0	84	82.2	17.5	144	140.9	29.9	204	199.5	42.4	264	258.2	54.9
25	24.5	05.2	85	83.1	17.7	145	141.8	30.1	205	200.5	42.6	265	259.2	55.1
26	25.4	05.4	86	84.1	17.9	146	142.8	30.4	206	201.5	42.8	266	260.2	55.3
27	26.4	05.6	87	85.1	18.1	147	143.8	30.6	207	202.5	43.0	267	261.2	55.5
28	27.4	05.8	88	86.1	18.3	148	144.8	30.8	208	203.5	43.2	268	262.1	55.7
29	28.4	06.0	89	87.1	18.5	149	145.7	31.0	209	204.4	43.5	269	263.1	55.9
30	29.3	06.2	90	88.0	18.7	150	146.7	31.2	210	205.4	43.7	270	264.1	56.1
31	30.3	06.4	91	89.0	18.9	151	147.7	31 4	211	206.4	43.9	271	265.1	56.3
32	31.3	06.7	92	90.0	19.1	152	148.7	31.6	212	207.4	44.1	272	266.1	56.6
33	32.3	06.9	93	91.0	19.3	153	149.7	31.8	213	208.3	44.3	273	267.0	56.8
34	33.3	07.1	94	91.9	19.5	154	150.6	32.0	214	209.3	44.5	274	268.0	57.0
35	34.2	07.3	95	92.9	19.8	155	151.6	32.2	215	210.3	44.7	275	269.0	57.2
36	35.2	07.5	96	93.9	20.0	156	152.6	32.4	216	211.3	44.9	276	270.0	57.4
37	36.2	07.7	97	94.9	20.2	157	153.6	32.6	217	212.3	45.1	277	270.9	57.6
38	37.2	07.9	98	95.9	20.4	158	154.5	32.9	218	213.2	45.3	278	271.9	57.8
39	38.1	08.1	99	96.8	20.6	159	155.5	33.1	219	214.2	45.5	279	272.9	58.0
40	39.1	08.3	100	97.8	20.8	160	156.5	33.3	220	215.2	45.7	280	273.9	58.2
41	40.1	08.5	101	98.8	21.0	161	157.5	33.5	221	216.2	45.9	281	274.9	58.4
42	41.1	08.7	102	99.8	21.2	162	158.5	33.7	222	217.1	46.2	282	275.8	58.6
43	42.1	08.9	103	100.7	21.4	163	159.4	33.9	223	218.1	46.4	283	276.8	58.8
44	43.0	09.1	104	101.7	21.6	164	160.4	34.1	224	219.1	46.6	284	277.8	59.0
45	44.0	09.4	105	102.7	21.8	165	161.4	34.3	225	220.1	46.8	285	278.8	59.3
46	45.0	09.6	106	103.7	22.0	166	162.4	34.5	226	221.1	47.0	286	279.8	59.5
47	46.0	09.8	107	104.7	22.2	167	163.4	34.7	227	222 0	47.2	287	280.7	59 7
48	47.0	10.0	108	105.6	22 5	168	164.3	34.9	228	223.0	47.4	288	281.7	59.9
49	47.9	10.2	109	106.6	22.7	169	165.3	35.1	229	224 0	47.6	289	282.7	60.1
50	48 9	10.4	110	107.6	22.9	170	166.3	35.3	230	225.0	47.8	290	283.7	60.3
51	49.9	10.6	111	108.6	23.1	171	167.3	35.6	231	226.0	48.0	291	284.6	60.5
52	50.9	10.8	112	109.6	23.3	172	168.2	35.8	232	226.9	48.2	292	285.6	60.7
53	51.8	11.0	113	110.5	23.5	173	169.2	36.0	233	227.9	48.4	293	286.6	60.9
54	52.8	11.2	114	111.5	23.7	174	170.2	36.2	234	228.9	48.7	294	287.6	61.1
55	53.8	11.4	115	112.5	23.9	175	171.2	36.4	235	229.9	48.9	295	288.6	61.3
56	54.8	11.6	116	113.5	24.1	176	172.2	36.6	236	230.8	49.1	296	289.5	61.5
57	55.8	11.9	117	114.4	24.3	177	173.1	36.8	237	231.8	49.3	297	290.5	61.7
58	56.7	12.1	118	115.4	24.5	178	174.1	37.0	238	232.8	49.5	298	291.5	62.0
59	57.7	12.3	119	116.4	24.7	179	175.1	37.2	239	233.8	49.7	299	292.5	62.2
60	58.7	12.5	120	117.4	24.9	180	176.1	37.4	240	234.8	49.9	300	293.4	62.4
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 78 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 13 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.2	61	59.4	13.7	121	117.9	27.2	181	176.4	40.7	241	234.8	54.2
2	01.9	00.4	62	60 4	13.9	122	118.9	27.4	182	177.3	40.9	242	235.8	54 4
3	02.9	00.7	63	61.4	14.2	123	119.8	27.7	183	178.3	41.2	243	236.8	54.7
4	03.9	00.9	64	62.4	14.4	124	120.8	27.9	184	179.3	41.4	244	237.7	54.9
5	04.9	01.1	65	63.3	14.6	125	121.8	28.1	185	180.3	41.6	245	238.7	55.1
6	05.8	01.3	66	64.3	14.8	126	122.8	28.3	186	181.2	41.8	246	239.7	55 3
7	06.8	01.6	67	65.3	15.1	127	123 7	28.6	187	182.2	42.1	247	240.7	55.6
8	07.8	01.8	68	66.3	15.3	128	124.7	28.8	188	183.2	42.3	248	241.6	55.8
9	08.8	02.0	69	67.2	15.5	129	125.7	29.0	189	184.2	42.5	249	242.6	56.0
10	09.7	02.2	70	68.2	15.7	130	126.7	29.2	190	185.1	42.7	250	243.6	56.2
11	10.7	02.5	71	69.2	16.0	131	127.6	29.5	191	186.1	43.0	251	244.6	56.5
12	11.7	02.7	72	70.2	16.2	132	128.6	29.7	192	187.1	43.2	252	245.5	56.7
13	12.7	02.9	73	71.1	16.4	133	129.6	29.9	193	188.1	43.4	253	246.5	56.9
14	13.6	03.1	74	72.1	16.6	134	130.6	30.1	194	189.0	43.6	254	247.5	57.1
15	14.6	03.4	75	73.1	16.9	135	131.5	30.4	195	190.0	43.9	255	248.5	57.4
16	15.6	03.6	76	74.1	17.1	136	132.5	30.6	196	191.0	44.1	256	249.4	57.6
17	16.6	03.8	77	75.0	17.3	137	133.5	30.8	197	192.0	44.3	257	250 4	57.8
18	17.5	04.0	78	76.0	17.5	138	134.5	31.0	198	192.9	44.5	258	251.4	58.0
19	18.5	04.3	79	77.0	17.8	139	135.4	31.3	199	193.9	44.8	259	252.4	58.3
20	19.5	04.5	80	77.9	18.0	140	136.4	31.5	200	194.9	45.0	260	253.3	58.5
21	20.5	04.7	81	78.9	18.2	141	137.4	31.7	201	195.8	45.2	261	254.3	58.7
22	21.4	04.9	82	79.9	18.4	142	138.4	31 9	202	196.8	45.4	262	255.3	58.9
23	22.4	05.2	83	80.9	18.7	143	139.3	32.2	203	197.8	45.7	263	256.3	59.2
24	23.4	05.4	84	81.8	18.9	144	140.3	32.4	204	198.8	45.9	264	257.2	59.4
25	24.4	05.6	85	82.8	19.1	145	141.3	32.6	205	199.7	46.1	265	258.2	59.6
26	25.3	05 8	86	83.8	19 3	146	142.3	32.8	206	200.7	46.3	266	259.2	59.8
27	26.3	06.1	87	84.8	19.6	147	143.2	33.1	207	201.7	46.6	267	260.2	60.1
28	27.3	06.3	88	85.7	19.8	148	144.2	33.3	208	202.7	46.8	268	261.1	60.3
29	28.3	06.5	89	86.7	20.0	149	145.2	33.5	209	203.6	47.0	269	262 1	60.5
30	29 2	06.7	90	87.7	20.2	150	146.2	33.7	210	204.6	47.2	270	263.1	60.7
31	30.2	07.0	91	88.7	20.5	151	147.1	34.0	211	205.6	47.5	271	264.1	61.0
32	31.2	07.2	92	89.6	20.7	152	148.1	34.2	212	206.6	47.7	272	265.0	61.2
33	32.2	07.4	93	90.6	20.9	153	149.1	34.4	213	207.5	47.9	273	266.0	61.4
34	33.1	07.6	94	91 6	21.1	154	150.1	34.6	214	208.5	48.1	274	267.0	61.6
35	34.1	07.9	95	92.6	21.4	155	151.0	34.9	215	209.5	48.4	275	268.0	61.9
36	35.1	08.1	96	93.5	21.6	156	152.0	35.1	216	210.5	48.6	276	268.9	62.1
37	36.1	08.3	97	94.5	21.8	157	153.0	35.3	217	211.4	48.8	277	269.9	62.3
38	37.0	08.5	98	95.5	22.0	158	154.0	35.5	218	212.4	49.0	278	270.9	62.5
39	38.0	08.8	99	96.5	22.3	159	154.9	35.8	219	213.4	49.3	279	271.8	62.8
40	39.0	09.0	100	97.4	22.5	160	155.9	36.0	220	214.4	49.5	280	272.8	63.0
41	39.9	09.2	101	98.4	22.7	161	156.9	36.2	221	215.3	49.7	281	273.8	63.2
42	40.9	09.4	102	99.4	22.9	162	157.8	36.4	222	216.3	49.9	282	274.8	63.4
43	41.9	09.7	103	100.4	23.2	163	158.8	36.7	223	217.3	50.2	283	275.7	63.7
44	42.9	09.9	104	101.3	23.4	164	159.8	36.9	224	218.3	50.4	284	276.7	63.9
45	43.8	10.1	105	102.3	23.6	165	160.8	37.1	225	219.2	50.6	285	277.7	64.1
46	44.8	10.3	106	103.3	23.8	166	161.7	37.3	226	220.2	50.8	286	278.7	64.3
47	45.8	10.6	107	104.3	24.1	167	162.7	37.6	227	221.2	51.1	287	279.6	64.6
48	46.8	10.8	108	105.2	24.3	168	163.7	37.8	228	222.2	51.3	288	280.6	64.8
49	47.7	11.0	109	106.2	24.5	169	164.7	38.0	229	223.1	51.5	289	281.6	65.0
50	48 7	11.2	110	107.2	24.7	170	165.6	38.2	230	224.1	51.7	290	282.6	65.2
51	49.7	11.5	111	108.2	25.0	171	166.6	38.5	231	225.1	52.0	291	283.5	65.5
52	50.7	11.7	112	109.1	25 2	172	167.6	38.7	232	226.1	52.2	292	284.5	65.7
53	51.6	11.9	113	110.1	25.4	173	168.6	38.9	233	227.0	52.4	293	285.5	65.9
54	52.6	12.1	114	111.1	25.6	174	169.5	39.1	234	228.0	52.6	294	286.5	66.1
55	53.6	12.4	115	112.1	25.9	175	170.5	39.4	235	229.0	52.9	295	287.4	66.4
56	54.6	12.6	116	113.0	26.1	176	171.5	39.6	236	230.0	53.1	296	288.4	66.6
57	55.5	12.8	117	114.0	26.3	177	172.5	39.8	237	230.9	53.3	297	289.4	66.8
58	56.5	13.0	118	115.0	26.5	178	173.4	40.0	238	231.9	53.5	298	290.4	67.0
59	57.5	13.3	119	116.0	26.8	179	174.4	40.3	239	232.9	53.8	299	291.3	67.3
60	58.5	13.5	120	116.9	27.0	180	175.4	40.5	240	233.8	54.0	300	292.3	67.5
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 77 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 14 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.2	61	59.2	14.8	121	117.4	29.3	181	175.6	43.8	241	233.8	58.3
2	01.9	00.5	62	60.2	15.0	122	118.4	29.5	182	176.6	44.0	242	234.8	58.5
3	02.9	00.7	63	61.1	15.2	123	119.3	29.8	183	177.6	44.3	243	235.8	58.8
4	03.9	01.0	64	62.1	15.5	124	120.3	30.0	184	178.5	44.5	244	236.8	59.0
5	04.9	01.2	65	63.1	15.7	125	121.3	30.2	185	179.5	44.8	245	237.7	59.3
6	05.8	01.5	66	64.0	16.0	126	122.3	30.5	186	180.5	45.0	246	238.7	59.5
7	06.8	01.7	67	65.0	16.2	127	123.2	30.7	187	181.4	45.2	247	239.7	59.8
8	07.8	01.9	68	66.0	16.5	128	124.2	31.0	188	182.4	45.5	248	240.6	60.0
9	08.7	02.2	69	67.0	16.7	129	125.2	31.2	189	183.4	45.7	249	241.6	60.2
10	09.7	02.4	70	67.9	16.9	130	126.1	31.4	190	184.4	46.0	250	242.6	60.5
11	10.7	02.7	71	68.9	17.2	131	127.1	31.7	191	185.3	46.2	251	243.5	60.7
12	11.6	02.9	72	69.9	17.4	132	128.1	31.9	192	186.3	46.4	252	244.5	61.0
13	12.6	03.1	73	70.8	17.7	133	129.0	32.2	193	187.3	46.7	253	245.5	61.2
14	13.6	03.4	74	71.8	17.9	134	130.0	32.4	194	188.2	46.9	254	246.5	61.4
15	14.6	03.6	75	72.8	18.1	135	131.0	32.7	195	189.2	47.2	255	247.4	61.7
16	15.5	03.9	76	73.7	18.4	136	132.0	32.9	196	190.2	47.4	256	248.4	61.9
17	16.5	04.1	77	74.7	18.6	137	132.9	33.1	197	191.1	47.7	257	249.4	62.2
18	17.5	04.4	78	75.7	18.9	138	133.9	33.4	198	192.1	47.9	258	250.3	62.4
19	18.4	04.6	79	76.7	19.1	139	134.9	33.6	199	193.1	48.1	259	251.3	62.7
20	19.4	04.8	80	77.6	19.4	140	135.8	33.9	200	194.1	48.4	260	252.3	62.9
21	20.4	05.1	81	78.6	19.6	141	136.8	34.1	201	195.0	48.6	261	253.2	63.1
22	21.3	05.3	82	79.6	19.8	142	137.8	34.4	202	196.0	48.9	262	254.2	63.4
23	22.3	05.6	83	80.5	20.1	143	138.8	34.6	203	197.0	49.1	263	255.2	63.6
24	23.3	05.8	84	81.5	20.3	144	139.7	34.8	204	197.9	49.4	264	256.2	63.9
25	24.3	06.0	85	82.5	20.6	145	140.7	35.1	205	198.9	49.6	265	257.1	64.1
26	25.2	06.3	86	83.4	20.8	146	141.7	35.3	206	199.9	49.8	266	258.1	64.4
27	26.2	06.5	87	84.4	21.0	147	142.6	35.6	207	200.9	50.1	267	259.1	64.6
28	27.2	06.8	88	85.4	21.3	148	143.6	35.8	208	201.8	50.3	268	260.0	64.8
29	28.1	07.0	89	86.4	21.5	149	144.6	36.0	209	202.8	50.6	269	261.0	65.1
30	29.1	07.3	90	87.3	21.8	150	145.5	36.3	210	203.8	50.8	270	262.0	65.3
31	30.1	07.5	91	88.3	22.0	151	146.5	36.5	211	204.7	51.0	271	263.0	65.6
32	31.0	07.7	92	89.3	22.3	152	147.5	36.8	212	205.7	51.3	272	263.9	65.8
33	32.0	08.0	93	90.2	22.5	153	148.5	37.0	213	206.7	51.5	273	264.9	66.0
34	33.0	08.2	94	91.2	22.7	154	149.4	37.3	214	207.6	51.8	274	265.9	66.3
35	34.0	08.5	95	92.2	23.0	155	150.4	37.5	215	208.6	52.0	275	266.8	66.5
36	34.9	08.7	96	93.1	23.2	156	151.4	37.7	216	209.6	52.3	276	267.8	66.8
37	35.9	09.0	97	94.1	23.5	157	152.3	38.0	217	210.6	52.5	277	268.8	67.0
38	36.9	09.2	98	95.1	23.7	158	153.3	38.2	218	211.5	52.7	278	269.7	67.3
39	37.8	09.4	99	96.1	24.0	159	154.3	38.5	219	212.5	53.0	279	270.7	67.5
40	38.8	09.7	100	97.0	24.2	160	155.2	38.7	220	213.5	53.2	280	271.7	67.7
41	39.8	09.9	101	98.0	24.4	161	156.2	38.9	221	214.4	53.5	281	272.7	68.0
42	40.8	10.2	102	99.0	24.7	162	157.2	39.2	222	215.4	53.7	282	273.6	68.2
43	41.7	10.4	103	99.9	24.9	163	158.2	39.4	223	216.4	53.9	283	274.6	68.5
44	42.7	10.6	104	100.9	25.2	164	159.1	39.7	224	217.3	54.2	284	275.6	68.7
45	43.7	10.9	105	101.9	25.4	165	160.1	39.9	225	218.3	54.4	285	276.5	68.9
46	44.6	11.1	106	102.9	25.6	166	161.1	40.2	226	219.3	54.7	286	277.5	69.2
47	45.6	11.4	107	103.8	25.9	167	162.0	40.4	227	220.3	54.9	287	278.5	69.4
48	46.6	11.6	108	104.8	26.1	168	163.0	40.6	228	221.2	55.2	288	279.4	69.7
49	47.5	11.9	109	105.8	26.4	169	164.0	40.9	229	222.2	55.4	289	280.4	69.9
50	48.5	12.1	110	106.7	26.6	170	165.0	41.1	230	223.2	55.6	290	281.4	70.2
51	49.5	12.3	111	107.7	26.9	171	165.9	41.4	231	224.1	55.9	291	282.4	70.4
52	50.5	12.6	112	108.7	27.1	172	166.9	41.6	232	225.1	56.1	292	283.3	70.6
53	51.4	12.8	113	109.6	27.3	173	167.9	41.9	233	226.1	56.4	293	284.3	70.9
54	52.4	13.1	114	110.6	27.6	174	168.8	42.1	234	227.0	56.6	294	285.3	71.1
55	53.4	13.3	115	111.6	27.8	175	169.8	42.3	235	228.0	56.9	295	286.2	71.4
56	54.3	13.5	116	112.6	28.1	176	170.8	42.6	236	229.0	57.1	296	287.2	71.6
57	55.3	13.8	117	113.5	28.3	177	171.7	42.8	237	230.0	57.3	297	288.2	71.9
58	56.3	14.0	118	114.5	28.6	178	172.7	43.1	238	230.9	57.6	298	289.1	72.1
59	57.2	14.3	119	115.5	28.8	179	173.7	43.3	239	231.9	57.8	299	290.1	72.3
60	58.2	14.5	120	116.4	29.0	180	174.7	43.5	240	232.9	58.1	300	291.1	72.6
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 76 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 15 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.3	61	58.9	15.8	121	116.9	31.3	181	174.8	46.8	241	232.8	62.4
2	01 9	00.5	62	59.9	16.0	122	117.8	31.6	182	175.8	47.1	242	233.8	62.6
3	02.9	00.8	63	60.9	16.3	123	118 8	31.8	183	176.8	47.4	243	234.7	62.9
4	03.9	01.0	64	61.8	16.6	124	119.8	32 1	184	177.7	47.6	244	235 7	63.2
5	04.8	01.3	65	62.8	16.8	125	120.7	32.4	185	178.7	47.9	245	236.7	63.4
6	05.8	01.6	66	63.8	17.1	126	121.7	32.6	186	179.7	48.1	246	237.6	63.7
7	06.8	01.8	67	64.7	17.3	127	122.7	32.9	187	180.6	48.4	247	238.6	63.9
8	07.7	02.1	68	65.7	17.6	128	123.6	33.1	188	181.6	48.7	248	239.5	64.2
9	08 7	02.3	69	66.6	17.9	129	124.6	33.4	189	182.6	48.9	249	240.5	64.4
10	09.7	02.6	70	67.6	18.1	130	125.6	33.6	190	183.5	49.2	250	241.5	64.7
11	10.6	02.8	71	68.6	18.4	131	126.5	33.9	191	184.5	49.4	251	242.4	65.0
12	11 6	03.1	72	69.5	18.6	132	127.5	34.2	192	185.5	49.7	252	243.4	65.2
13	12.6	03 4	73	70.5	18.9	133	128.5	34.4	193	186.4	50.0	253	244.4	65.5
14	13.5	03.6	74	71.5	19.2	134	129.4	34.7	194	187.4	50 2	254	245.3	65.7
15	14.5	03.9	75	72.4	19.4	135	130.4	34.9	195	188.4	50.5	255	246.3	66.0
16	15.5	04.1	76	73.4	19.7	136	131.4	35.2	196	189.3	50.7	256	247.3	66.3
17	16.4	04.4	77	74.4	19.9	137	132.3	35.5	197	190.3	51.0	257	248.2	66.5
18	17.4	04.7	78	75.3	20.2	138	133.3	35.7	198	191.3	51.2	258	249.2	66.8
19	18.4	04.9	79	76 3	20.4	139	134.3	36.0	199	192.2	51.5	259	250.2	67.0
20	19.3	05.2	80	77 3	20.7	140	135.2	36.2	200	193.2	51.8	260	251.1	67.3
21	20.3	05.4	81	78.2	21.0	141	136.2	36.5	201	194.2	52.0	261	252.1	67.6
22	21.3	05.7	82	79.2	21.2	142	137.2	36.8	202	195.1	52.3	262	253.1	67.8
23	22.2	06.0	83	80.2	21.5	143	138.1	37.0	203	196.1	52.5	263	254.0	68.1
24	23.2	06.2	84	81.1	21.7	144	139.1	37.3	204	197.0	52.8	264	255.0	68.3
25	24.1	06.5	85	82.1	22.0	145	140.1	37.5	205	198.0	53.1	265	256.0	68.6
26	25.1	06.7	86	83.1	22.3	146	141.0	37.8	206	199.0	53.3	266	256.9	68.8
27	26.1	07.0	87	84.0	22.5	147	142.0	38.0	207	199.9	53.6	267	257.9	69.1
28	27.0	07.2	88	85.0	22.8	148	143.0	38.3	208	200.9	53.8	268	258.9	69.4
29	28.0	07.5	89	86.0	23.0	149	143.9	38.6	209	201.9	54.1	269	259.8	69.6
30	29.0	07.8	90	86.9	23.3	150	144.9	38.8	210	202.8	54.4	270	260.8	69.9
31	29.9	08.0	91	87.9	23.6	151	145.9	39.1	211	203.8	54.6	271	261.8	70.1
32	30.9	08.3	92	88.9	23.8	152	146.8	39.3	212	204.8	54.9	272	262.7	70.4
33	31.9	08.5	93	89.8	24.1	153	147.8	39.6	213	205.7	55.1	273	263.7	70.7
34	32.8	08.8	94	90.8	24.3	154	148.8	39.9	214	206.7	55.4	274	264.7	70.9
35	33.8	09.1	95	91.8	24.6	155	149.7	40.1	215	207.7	55.6	275	265.6	71.2
36	34.8	09.3	96	92.7	24.8	156	150.7	40.4	216	208.6	55.9	276	266.6	71.4
37	35.7	09.6	97	93.7	25.1	157	151.7	40.6	217	209.6	56.2	277	267.6	71.7
38	36.7	09.8	98	94.7	25.4	158	152.6	40.9	218	210.6	56.4	278	268.5	72.0
39	37.7	10.1	99	95.6	25.6	159	153.6	41.2	219	211.5	56.7	279	269.5	72.2
40	38.6	10.4	100	96.6	25.9	160	154.5	41.4	220	212.5	56.9	280	270.5	72.5
41	39.6	10.6	101	97.6	26.1	161	155.5	41.7	221	213 5	57.2	281	271.4	72.7
42	40.6	10.9	102	98.5	26.4	162	156.5	41.9	222	214.4	57.5	282	272.4	73.0
43	41.5	11.1	103	99.5	26.7	163	157.4	42.2	223	215.4	57.7	283	273.4	73.2
44	42.5	11.4	104	100.5	26.9	164	158 4	42.4	224	216.4	58.0	284	274.3	73.5
45	43.5	11.6	105	101.4	27.2	165	159.4	42.7	225	217.3	58.2	285	275.3	73.8
46	44.4	11.9	106	102.4	27.4	166	160 3	43.0	226	218.3	58.5	286	276.3	74.0
47	45.4	12.2	107	103.4	27.7	167	161.3	43.2	227	219.3	58.8	287	277.2	74.3
48	46.4	12.4	108	104.3	28.0	168	162.3	43.5	228	220.2	59.0	288	278.2	74.5
49	47.3	12.7	109	105.3	28.2	169	163.2	43.7	229	221.2	59.3	289	279.2	74.8
50	48.3	12.9	110	106.3	28.5	170	164.2	44.0	230	222.2	59.5	290	280.1	75.1
51	49.3	13.2	111	107.2	28.7	171	165.2	44.3	231	223.1	59.8	291	281.1	75.3
52	50.2	13.5	112	108.2	29.0	172	166.1	44.5	232	224.1	60.0	292	282.1	75.6
53	51.2	13.7	113	109.1	29.2	173	167.1	44.8	233	225.1	60.3	293	283.0	75.8
54	52.2	14.0	114	110.1	29.5	174	168.1	45.0	234	226.0	60.6	294	284.0	76.1
55	53.1	14.2	115	111.1	29.8	175	169.0	45.3	235	227.0	60.8	295	284.9	76.4
56	54.1	14.5	116	112.0	30.0	176	170.0	45.6	236	228.0	61.1	296	285.9	76 6
57	55.1	14.8	117	113.0	30.3	177	171.0	45.8	237	228.9	61.3	297	286.9	76 9
58	56.0	15.0	118	114.0	30.5	178	171.9	46.1	238	229.9	61.6	298	287.8	77.1
59	57.0	15.3	119	114.9	30 8	179	172.9	46.3	239	230.9	61.9	299	288.8	77.4
60	58 0	15.5	120	115.9	31.1	180	173.9	46.6	240	231.8	62.1	300	289.8	77.6
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 75 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 16 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.3	61	58.6	16.8	121	116.3	33.4	181	174.0	49.9	241	231.7	66.4
2	01.9	00.6	62	59.6	17.1	122	117.3	33.6	182	174.9	50.2	242	232.6	66.7
3	02.9	00.8	63	60.6	17.4	123	118.2	33.9	183	175.9	50.4	243	233.6	67.0
4	03.8	01.1	64	61.5	17.6	124	119.2	34.2	184	176.9	50.7	244	234.5	67.3
5	04.8	01.4	65	62.5	17.9	125	120.2	34.5	185	177.8	51.0	245	235.5	67.5
6	05.8	01.7	66	63.4	18.2	126	121.1	34.7	186	178.8	51.3	246	236.5	67.8
7	06.7	01.9	67	64.4	18.5	127	122.1	35.0	187	179.8	51.5	247	237.4	68.1
8	07.7	02.2	68	65.4	18.7	128	123.0	35.3	188	180.7	51.8	248	238.4	68.4
9	08.7	02.5	69	66.3	19.0	129	124.0	35.6	189	181.7	52.1	249	239.4	68.6
10	09.6	02.8	70	67.3	19.3	130	125.0	35.8	190	182.6	52.4	250	240.3	68.9
11	10.6	03.0	71	68.2	19.6	131	125.9	36.1	191	183.6	52.6	251	241.3	69.2
12	11.5	03.3	72	69.2	19.8	132	126.9	36.4	192	184.6	52.9	252	242.2	69.5
13	12.5	03.6	73	70.2	20.1	133	127.8	36.7	193	185.5	53.2	253	243.2	69.7
14	13.5	03 9	74	71.1	20.4	134	128.8	36.9	194	186.5	53.5	254	244.2	70.0
15	14.4	04.1	75	72.1	20.7	135	129.8	37.2	195	187.4	53.7	255	245.1	70.3
16	15.4	04.4	76	73.1	20.9	136	130.7	37.5	196	188.4	54.0	256	246.1	70.6
17	16.3	04.7	77	74.0	21.2	137	131.7	37.8	197	189.4	54.3	257	247.0	70.8
18	17.3	05.0	78	75.0	21.5	138	132.7	38.0	198	190.3	54.6	258	248.0	71.1
19	18.3	05.2	79	75.9	21.8	139	133.6	38.3	199	191.3	54.9	259	249.0	71.4
20	19.2	05.5	80	76.9	22.1	140	134.6	38.6	200	192.3	55.1	260	249.9	71.7
21	20.2	05.8	81	77.9	22.3	141	135.5	38.9	201	193.2	55.4	261	250.9	71.9
22	21.1	06.1	82	78.8	22.6	142	136.5	39 1	202	194.2	55.7	262	251.9	72.2
23	22.1	06.3	83	79.8	22.9	143	137.5	39.4	203	195.1	56.0	263	252.8	72.5
24	23.1	06.6	84	80.7	23.2	144	138.4	39.7	204	196.1	56.2	264	253.8	72.8
25	24.0	06.9	85	81.7	23.4	145	139.4	40.0	205	197.1	56 5	265	254.7	73.0
26	25.0	07.2	86	82.1	23.7	146	140.3	40.2	206	198.0	56.8	266	255.7	73.3
27	26.0	07.4	87	83.6	24.0	147	141.3	40.5	207	199.0	57.1	267	256.7	73.6
28	26.9	07.7	88	84.6	24.3	148	142.3	40.8	208	199.9	57.3	268	257.6	73.9
29	27.9	08.0	89	85.6	24.5	149	143.2	41.1	209	200.9	57.6	269	258.6	74.1
30	28.8	08.3	90	86.5	24.8	150	144.2	41.3	210	201.9	57.9	270	259.5	74.4
31	29.8	08.5	91	87.5	25.1	151	145.2	41.6	211	202.8	58.2	271	260.5	74.7
32	30.8	08.8	92	88.4	25.4	152	146.1	41.9	212	203.8	58.4	272	261.5	75.0
33	31.7	09.1	93	89.4	25.6	153	147.1	42.2	213	204.7	58.7	273	262.4	75.2
34	32.7	09.4	94	90.4	25.9	154	148.0	42.4	214	205.7	59.0	274	263.4	75.5
35	33.6	09.6	95	91.3	26.2	155	149.0	42.7	215	206.7	59.3	275	264.3	75.8
36	34.6	09.9	96	92.3	26.5	156	150.0	43.0	216	207.6	59.5	276	265.3	76.1
37	35.6	10.2	97	93.2	26.7	157	150.9	43.3	217	208.6	59.8	277	266.3	76.4
38	36.5	10.5	98	94.2	27.0	158	151.9	43.6	218	209.6	60.1	278	267.2	76.6
39	37.5	10.7	99	95.2	27.3	159	152.8	43.8	219	210.5	60.4	279	268.2	76 9
40	38.5	11.0	100	96.1	27.6	160	153.8	44.1	220	211.5	60.6	280	269.2	77.2
41	39.4	11.3	101	97.1	27.8	161	154.8	44.4	221	212.4	60.9	281	270.1	77.5
42	40.4	11.6	102	98.0	28.1	162	155.7	44.7	222	213.4	61.2	282	271.1	77.7
43	41.3	11.9	103	99.0	28.4	163	156.7	44.9	223	214.4	61.5	283	272.0	78.0
44	42.3	12.1	104	100.0	28.7	164	157.6	45.2	224	215.3	61.7	284	273.0	78.3
45	43.3	12.4	105	100.9	28.9	165	158.6	45.5	225	216.3	62.0	285	274.0	78.6
46	44.2	12.7	106	101.9	29.2	166	159.6	45.8	226	217.2	62.3	286	244.9	78.8
47	45.2	13.0	107	102.9	29.5	167	160.5	46.0	227	218.2	62.6	287	275.9	79.1
48	46.1	13.2	108	103.8	29.8	168	161.5	46.3	228	219.2	62.8	288	276.8	79.4
49	47.1	13.5	109	104.8	30.0	169	162.5	46.6	229	220.1	63.1	289	277.8	79.7
50	48.1	13.8	110	105.7	30.3	170	163.4	46.9	230	221.1	63.4	290	278.8	79.9
51	49.0	04.1	111	106.7	30.6	171	164.4	47.1	231	222.1	63 7	291	279.7	80.2
52	50.0	14.3	112	107.7	30.9	172	165.3	47.4	232	223.0	63.9	292	280.7	80 5
53	50.9	14.6	113	108.6	31.1	173	166.3	47.7	233	224.0	64.2	293	281.6	80.8
54	51.9	14.9	114	109.6	31.4	174	167.3	48.0	234	224.9	64.5	294	282.6	81.0
55	52.9	15 2	115	110.5	31.7	175	168.2	48.2	235	225.9	64.8	295	283.6	81.3
56	53.8	15.4	116	111.5	32.0	176	169.2	48.5	236	226.9	65.1	296	284.5	81.6
57	54.8	15.7	117	112.5	32.2	177	170.1	48.8	237	227.8	65.3	297	285.5	81.9
58	55.8	16.0	118	113.4	32.5	178	171.1	49.1	238	228.8	65.6	298	286.5	82.1
59	56.7	16.3	119	114.4	32.8	179	172.1	49.3	239	229.7	65.9	299	287.4	82.4
60	57.7	16.5	120	115.4	33.1	180	173.0	49.6	240	230.7	66.2	300	288.4	82.7
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 74 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 17 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.3	61	58 3	17.8	121	115.7	35.4	181	173.1	52.9	241	230.5	70.5
2	01 9	00.6	62	59.3	18.1	122	116.7	35.7	182	174.0	53.2	242	231.4	70.8
3	02.9	00.9	63	60.2	18.4	123	117.6	36.0	183	175.0	53.5	243	232.4	71.0
4	03.8	01.2	64	61.2	18.7	124	118.6	36.3	184	176.0	53 8	244	233.3	71.3
5	04.8	01.5	65	62.2	19.0	125	119.5	36.5	185	176.9	54.1	245	234.3	71 6
6	05.7	01.8	66	63.1	19.3	126	120.5	36.8	186	177 9	54.4	246	235.3	71.9
7	06.7	02.0	67	64.1	19.6	127	121.5	37.1	187	178.8	54.7	247	236.2	72.2
8	07.7	02.3	68	65.0	19.9	128	122.4	37.4	188	179.8	55.0	248	237.2	72.5
9	08.6	02.6	69	66.0	20.2	129	123.4	37.7	189	180.7	55.3	249	238.1	72.8
10	09.6	02.9	70	66.9	20.5	130	124.3	38.0	190	181.7	55.6	250	239.1	73.1
11	10.5	03.2	71	67.9	20.8	131	125 3	38.3	191	182.7	55 8	251	240.0	73.4
12	11.5	03.5	72	68.9	21.1	132	126.2	38.6	192	183.6	56.1	252	241.0	73.7
13	12.4	03.8	73	69.8	21.3	133	127.2	38.9	193	184.6	56 4	253	241.9	74.0
14	13.4	04.1	74	70.8	21.6	134	128.1	39 2	194	185.5	56.7	254	242.9	74.3
15	14.3	04.4	75	71.7	21.9	135	129.1	39.5	195	186.5	57.0	255	243 9	74.6
16	15.3	04 7	76	72.7	22.2	136	130.1	39.8	196	187.4	57.3	256	244.8	74.8
17	16.3	05.0	77	73.6	22.5	137	131.0	40.1	197	188.4	57 6	257	245.8	75.1
18	17.2	05.3	78	74.6	22.8	138	132.0	40.3	198	189.3	57.9	258	246.7	75.4
19	18.2	05.6	79	75.5	23.1	139	132.9	40.6	199	190.3	58.2	259	247.7	75.7
20	19.1	05.8	80	76.5	23.3	140	133.9	40.9	200	191 3	58.5	260	248.6	76 0
21	20.1	06.1	81	77.5	23.7	141	134.8	41.2	201	192.2	58.8	261	249.6	76.3
22	21 0	06 4	82	78.4	24.0	142	135.8	41.5	202	193.2	59.1	262	250.6	76.6
23	22.0	06.7	83	79.4	24.3	143	136.8	41.8	203	194.1	59.4	263	251 5	76.9
24	23.0	07.0	84	80.3	24 6	144	137.7	42.1	204	195.1	59.6	264	252.5	77.2
25	23.9	07.3	85	81.3	24.9	145	138.7	42.4	205	196.0	59.9	265	253.4	77.5
26	24.9	07.6	86	82.2	25.1	146	139 6	42.7	206	197.0	60.2	266	254.4	77.8
27	25.8	07.9	87	83.2	25.4	147	140.6	43.0	207	198.0	60.5	267	255.3	78.1
28	26.8	08.2	88	84.2	25.7	148	141.5	43.3	208	198.9	60.8	268	256.3	78.4
29	27.7	08.5	89	85.1	26.0	149	142.5	43.6	209	199.9	61.1	269	257.2	78.6
30	28.7	08.8	90	86.1	26.3	150	143.4	43.9	210	200.8	61.4	270	258.2	78.9
31	29.6	09.1	91	87.0	26.6	151	144.4	44.1	211	201.8	61.7	271	259 2	79.2
32	30.6	09.4	92	88.0	26.9	152	145.4	44.4	212	202.7	62.0	272	260.1	79.5
33	31.6	09.6	93	88.9	27.2	153	146.3	44.7	213	203.7	62.3	273	261.1	79.8
34	32.5	09.9	94	89.9	27.5	154	147.3	45.0	214	204.6	62.6	274	262.0	80.1
35	33.5	10.2	95	90.8	27.8	155	148.2	45.3	215	205.6	62.9	275	263.0	80.4
36	34.4	10.5	96	91.8	28.1	156	149.2	45.6	216	206.6	63.2	276	263.9	80.7
37	35.4	10.8	97	92.8	28.4	157	150.1	45.9	217	207.5	63.4	277	264.9	81.0
38	36.3	11.1	98	93.7	28.7	158	151.1	46.2	218	208.5	63.7	278	265.9	81.3
39	37.3	11.4	99	94.7	28.9	159	152.1	46.5	219	209.4	64.0	279	266.8	81.6
40	38.3	11.7	100	95.6	29.2	160	153.0	46.8	220	210.4	64.3	280	267.8	81.9
41	39.2	12.0	101	96.6	29.5	161	154.0	47.1	221	211.3	64.6	281	268.7	82.2
42	40.2	12.3	102	97.5	29.8	162	154.9	47.4	222	212.3	64.9	282	269.7	82.4
43	41 1	12.6	103	98.5	30.1	163	155.9	47.7	223	213.3	65.2	283	270.6	82.7
44	42.1	12.9	104	99.5	30.4	164	156.8	47.9	224	214.2	65.5	284	271.6	83.0
45	43.0	13 2	105	100.4	30.7	165	157.8	48.2	225	215.2	65.8	285	272.5	83.3
46	44.0	13.4	106	101.4	31.0	166	158.7	48.5	226	216.1	66.1	286	273.5	83.6
47	44.9	13.7	107	102.3	31.3	167	159.7	48.8	227	217.1	66.4	287	274.5	83.9
48	45.9	14.0	108	103.3	31.6	168	160.7	49.1	228	218.0	66.7	288	275.4	84.2
49	46.9	14.3	109	104.2	31.9	169	161.6	49.4	229	219.0	67.0	289	276.4	84.5
50	47.8	14.6	110	105.2	32.2	170	162.6	49.7	230	220.0	67.2	290	277.3	84.8
51	48.8	14.9	111	106.1	32.5	171	163.5	50.0	231	220.9	67.5	291	278.3	85.1
52	49.7	15.2	112	107.1	32.7	172	164.5	50.3	232	221.9	67.8	292	279.2	85.4
53	50.7	15.5	113	108.1	33.0	173	165.4	50.6	233	222.8	68.1	293	280.2	85.7
54	51.6	15.8	114	109.0	33.3	174	166.4	50.9	234	223.8	68.4	294	281.2	86.0
55	52.6	16.1	115	110.0	33.6	175	167.4	51.2	235	224.7	68.7	295	282.1	86.2
56	53.6	16.4	116	110.9	33.9	176	168.3	51.5	236	225.7	69.0	296	283.1	86.5
57	54.5	16.7	117	111.9	34.2	177	169.3	51.7	237	226.6	69.3	297	284.0	86.8
58	55.5	17.0	118	112.8	34.5	178	170.2	52.0	238	227.6	69.6	298	285.0	87.1
59	56.4	17.2	119	113.8	34.8	179	171.2	52.3	239	228.6	69.9	299	285.9	87.4
60	57.4	17.5	120	114.8	35.1	180	172.1	52.6	240	229.5	70.2	300	286.9	87.7
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 73 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 18 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	01.0	00.3	61	58.0	18.9	121	115.1	37.4	181	172.1	55.9	241	229.2	74.5
2	01.9	00.6	62	59.0	19.2	122	116.0	37.7	182	173.1	56.2	242	230.2	74.8
3	02.9	00.9	63	59.9	19.5	123	117.0	38.0	183	174.0	56.6	243	231.1	75.1
4	03.8	01.2	64	60.9	19.8	124	117.9	38.3	184	175.0	56.9	244	232.1	75.4
5	04.8	01.5	65	61.8	20.1	125	118.9	38.6	185	175.9	57.2	245	233.0	75.7
6	05.7	01.9	66	62.8	20.4	126	119.8	38.9	186	176.9	57.5	246	234.0	76.0
7	06.7	02.2	67	63.7	20.7	127	120.8	39.2	187	177.8	57.8	247	234.9	76.3
8	07.6	02.5	68	64.7	21.0	128	121.7	39.6	188	178.8	58.1	248	235.9	76.6
9	08.6	02.8	69	65.6	21.3	129	122.7	39.9	189	179.7	58.4	249	236.8	76.9
10	09.5	03.1	70	66.6	21.6	130	123.6	40.2	190	180.7	58.7	250	237.8	77.3
11	10.5	03.4	71	67.5	21.9	131	124.6	40.5	191	181.7	59.0	251	238.7	77.6
12	11.4	03.7	72	68.5	22.2	132	125.5	40.8	192	182.6	59.3	252	239.7	77.9
13	12.4	04.0	73	69.4	22.6	133	126.5	41.1	193	183.6	59.6	253	240.6	78.2
14	13.3	04.3	74	70.4	22.9	134	127.4	41.4	194	184.5	59.9	254	241.6	78.5
15	14.3	04.6	75	71.3	23.2	135	128.4	41.7	195	185.5	60.3	255	242.5	78.8
16	15.2	04.9	76	72.3	23.5	136	129.3	42.0	196	186.4	60.6	256	243.5	79.1
17	16.2	05.3	77	73.2	23.8	137	130.3	42.3	197	187.4	60.9	257	244.4	79.4
18	17.1	05.6	78	74.2	24.1	138	131.2	42.6	198	188.3	61.2	258	245.4	79.7
19	18.1	05.9	79	75.1	24.4	139	132.2	43.0	199	189.3	61.5	259	246.3	80.0
20	19.0	06.2	80	76.1	24.7	140	133.1	43.3	200	190.2	61.8	260	247.3	80.3
21	20.0	06.5	81	77.0	25.0	141	134.1	43.6	201	191.2	62.1	261	248.2	80.7
22	20.9	06.8	82	78.0	25.3	142	135.1	43.9	202	192.1	62.4	262	249.2	81.0
23	21.9	07.1	83	78.9	25.6	143	136.0	44.2	203	193.1	62.7	263	250.1	81.3
24	22.8	07.4	84	79.9	26.0	144	137.0	44.5	204	194.0	63.0	264	251.1	81.6
25	23.8	07.7	85	80.8	26.3	145	137.9	44.8	205	195.0	63.3	265	252.0	81.9
26	24.7	08.0	86	81.8	26.6	146	138.9	45.1	206	195.9	63.7	266	253.0	82.2
27	25.7	08.3	87	82.7	26.9	147	139.8	45.4	207	196.9	64.0	267	253.9	82.5
28	26.6	08.7	88	83.7	27.2	148	140.8	45.7	208	197.8	64.3	268	254.9	82.8
29	27.6	09.0	89	84.6	27.5	149	141.7	46.0	209	198.8	64.6	269	255.8	83.1
30	28.5	09.3	90	85.6	27.8	150	142.7	46.4	210	199.7	64.9	270	256.8	83.4
31	29.5	09.6	91	86.5	28.1	151	143.6	46.7	211	200.7	65.2	271	257.7	83.7
32	30.4	09.9	92	87.5	28.4	152	144.6	47.0	212	201.6	65.5	272	258.7	84.1
33	31.4	10.2	93	88.4	28.7	153	145.5	47.3	213	202.6	65.8	273	259.6	84.4
34	32.3	10.5	94	89.4	29.0	154	146.5	47.6	214	203.5	66.1	274	260.6	84.7
35	33.3	10.8	95	90.4	29.4	155	147.4	47.9	215	204.5	66.4	275	261.5	85.0
36	34.2	11.1	96	91.3	29.7	156	148.4	48.2	216	205.4	66.7	276	262.5	85.3
37	35.2	11.4	97	92.3	30.0	157	149.3	48.5	217	206.4	67.1	277	263.4	85.6
38	36.1	11.7	98	93.2	30.3	158	150.3	48.8	218	207.3	67.4	278	264.4	85.9
39	37.1	12.1	99	94.2	30.6	159	151.2	49.1	219	208.3	67.7	279	265.3	86.2
40	38.0	12.4	100	95.1	30.9	160	152.2	49.4	220	209.2	68.0	280	266.3	86.5
41	39.0	12.7	101	96.1	31.2	161	153.1	49.8	221	210.2	68.3	281	267.2	86.8
42	39.9	13.0	102	97.0	31.5	162	154.1	50.1	222	211.1	68.6	282	268.2	87.1
43	40.9	13.3	103	98.0	31.8	163	155.0	50.4	223	212.1	68.9	283	269.1	87.5
44	41.8	13.6	104	98.9	32.1	164	156.0	50.7	224	213.0	69.2	284	270.1	87.8
45	42.8	13.9	105	99.9	32.4	165	156.9	51.0	225	214.0	69.5	285	271.1	88.1
46	43.7	14.2	106	100.8	32.8	166	157.9	51.3	226	214.9	69.8	286	272.0	88.4
47	44.7	14.5	107	101.8	33.1	167	158.8	51.6	227	215.9	70.1	287	273.0	88.7
48	45.7	14.8	108	102.7	33.4	168	159.8	51.9	228	216.8	70.5	288	273.9	89.0
49	46.6	15.1	109	103.7	33.7	169	160.7	52.2	229	217.8	70.8	289	274.9	89.3
50	47.6	15.5	110	104.6	34.0	170	161.7	52.5	230	218.7	71.1	290	275.8	89.6
51	48.5	15.8	111	105.6	34.3	171	162.6	52.8	231	219.7	71.4	291	276.8	89.9
52	49.5	16.1	112	106.5	34.6	172	163.6	53.2	232	220.6	71.7	292	277.7	90.2
53	50.4	16.4	113	107.5	34.9	173	164.5	53.5	233	221.6	72.0	293	278.7	90.5
54	51.4	16.7	114	108.4	35.2	174	165.5	53.8	234	222.5	72.3	294	279.6	90.9
55	52.3	17.0	115	109.4	35.5	175	166.4	54.1	235	223.5	72.6	295	280.6	91.2
56	53.3	17.3	116	110.3	35.8	176	167.4	54.4	236	224.4	72.9	296	281.5	91.5
57	54.2	17.6	117	111.3	36.2	177	168.3	54.7	237	225.4	73.2	297	282.5	91.8
58	55.2	17.9	118	112.2	36.5	178	169.3	55.0	238	226.4	73.5	298	283.4	92.1
59	56.1	18.2	119	113.2	36.8	179	170.2	55.3	239	227.3	73.9	299	284.4	92.4
60	57.1	18.5	120	114.1	37.1	180	171.2	55.6	240	228.3	74.2	300	285.3	92.7
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 72 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 19 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.3	61	57.7	19.9	121	114.4	39.4	181	171.1	58.9	241	227.9	78.5
2	01.9	00.7	62	58.6	20.2	122	115.4	39.7	182	172.1	59.3	242	228.8	78.8
3	02.8	01.0	63	59.6	20.5	123	116.3	40.0	183	173.0	59.6	243	229.8	79.1
4	03.8	01.3	64	60.5	20.8	124	117.2	40.4	184	174.0	59.9	244	230.7	79.4
5	04.7	01.6	65	61.5	21.2	125	118.2	40.7	185	174.9	60.2	245	231.7	79.8
6	05.7	02.0	66	62.4	21.5	126	119.1	41.0	186	175.9	60.6	246	232.6	80.1
7	06.6	02.3	67	63.3	21.8	127	120.1	41.3	187	176.8	60.9	247	233.5	80.4
8	07.6	02.6	68	64.3	22.1	128	121.0	41.7	188	177.8	61.2	248	234.5	80.7
9	08.5	02.9	69	65.2	22.5	129	122.0	42.0	189	178.7	61.5	249	235.4	81.1
10	09.5	03.3	70	66.2	22.8	130	122.9	42.3	190	179.6	61.9	250	236.4	81.4
11	10.4	03.6	71	67.1	23.1	131	123.9	42.6	191	180.6	62.2	251	237.3	81.7
12	11.3	03.9	72	68.1	23.4	132	124.8	43.0	192	181.5	62.5	252	238.3	82.0
13	12.3	04.2	73	69.0	23.8	133	125.8	43.3	193	182.5	62.8	253	239.2	82.4
14	13.2	04.6	74	70.0	24.1	134	126.7	43.6	194	183.4	63.2	254	240.2	82.7
15	14.2	04.9	75	70.9	24.4	135	127.6	44.0	195	184.4	63.5	255	241.1	83.0
16	15.1	05.2	76	71.9	24.7	136	128.6	44.3	196	185.3	63.8	256	242.1	83.3
17	16.1	05.5	77	72.8	25.1	137	129.5	44.6	197	186.3	64.1	257	243.0	83.7
18	17.0	05.9	78	73.8	25.4	138	130.5	44.9	198	187.2	64.5	258	243.9	84.0
19	18.0	06.2	79	74.7	25.7	139	131.4	45.3	199	188.2	64.8	259	244.9	84.3
20	18.9	06.5	80	75.6	26.0	140	132.4	45.6	200	189.1	65.1	260	245.8	84.6
21	19.9	06.8	81	76.6	26.4	141	133.3	45.9	201	190.0	65.4	261	246.8	85.0
22	20.8	07.2	82	77.5	26.7	142	134.3	46.2	202	191.0	65.8	262	247.7	85.3
23	21.7	07.5	83	78.5	27.0	143	135.2	46.6	203	191.9	66.1	263	248.7	85.6
24	22.7	07.8	84	79.4	27.3	144	136.2	46.9	204	192.9	66.4	264	249.6	86.0
25	23.6	08.1	85	80.4	27.7	145	137.1	47.2	205	193.8	66.7	265	250.6	86.3
26	24.6	08.5	86	81.3	28.0	146	138.0	47.5	206	194.8	67.1	266	251.5	86.6
27	25.5	08.8	87	82.3	28.3	147	139.0	47.9	207	195.7	67.4	267	252.5	86.9
28	26.5	09.1	88	83.2	28.7	148	139.9	48.2	208	196.7	67.7	268	253.4	87.3
29	27.4	09.4	89	84.2	29.0	149	140.9	48.5	209	197.6	68.0	269	254.3	87.6
30	28.4	09.8	90	85.1	29.3	150	141.8	48.8	210	198.6	68.4	270	255.3	87.8
31	29.3	10.1	91	86.0	29.6	151	142.8	49.2	211	199.5	68.7	271	256.2	88.2
32	30.3	10.4	92	87.0	30.0	152	143.7	49.5	212	200.4	69.0	272	257.2	88.6
33	31.2	10.7	93	87.9	30.3	153	144.7	49.8	213	201.4	69.3	273	258.1	88.9
34	32.1	11.1	94	88.9	30.6	154	145.6	50.1	214	202.3	69.7	274	259.1	89.2
35	33.1	11.4	95	89.8	30.9	155	146.6	50.5	215	203.3	70.0	275	260.0	89.5
36	34.0	11.7	96	90.8	31.3	156	147.5	50.8	216	204.2	70.3	276	261.0	89.9
37	35.0	12.0	97	91.7	31.6	157	148.4	51.1	217	205.2	70.6	277	261.9	90.2
38	35.9	12.4	98	92.7	31.9	158	149.4	51.4	218	206.1	71.0	278	262.9	90.5
39	36.9	12.7	99	93.6	32.2	159	150.3	51.8	219	207.1	71.3	279	263.8	90.8
40	37.8	13.0	100	94.6	32.6	160	151.3	52.1	220	208.0	71.6	280	264.7	91.2
41	38.8	13.3	101	95.5	32.9	161	152.2	52.4	221	209.0	72.0	281	265.7	91.5
42	39.7	13.7	102	96.4	33.2	162	153.2	52.7	222	209.9	72.3	282	266.6	91.8
43	40.7	14.0	103	97.4	33.5	163	154.1	53.1	223	210.9	72.6	283	267.6	92.1
44	41.6	14.3	104	98.3	33.9	164	155.1	53.4	224	211.8	72.9	284	268.5	92.5
45	42.5	14.7	105	99.3	34.2	165	156.0	53.7	225	212.7	73.3	285	269.5	92.8
46	43.5	15.0	106	100.2	34.5	166	157.0	54.0	226	213.7	73.6	286	270.4	93.1
47	44.4	15.3	107	101.2	34.8	167	157.9	54.4	227	214.6	73.9	287	271.4	93.4
48	45.4	15.6	108	102.1	35.2	168	158.8	54.7	228	215.6	74.2	288	272.3	93.8
49	46.3	16.0	109	103.1	35.5	169	159.8	55.0	229	216.5	74.6	289	273.3	94.1
50	47.3	16.3	110	104.0	35.8	170	160.7	55.3	230	217.5	74.9	290	274.2	94.4
51	48.2	16.6	111	105.0	36.1	171	161.7	55.7	231	218.4	75.2	291	275.1	94.7
52	49.2	16.9	112	105.9	36.5	172	162.6	56.0	232	219.4	75.5	292	276.1	95.1
53	50.1	17.3	113	106.8	36.8	173	163.6	56.3	233	220.3	75.9	293	277.0	95.4
54	51.1	17.6	114	107.8	37.1	174	164.5	56.6	234	221.3	76.2	294	278.0	95.7
55	52.0	17.9	115	108.7	37.4	175	165.5	57.0	235	222.2	76.5	295	278.9	96.0
56	52.9	18.2	116	109.7	37.8	176	166.4	57.3	236	223.1	76.8	296	279.9	96.4
57	53.9	18.6	117	110.6	38.1	177	167.4	57.6	237	224.1	77.2	297	280.8	96.7
58	54.8	18.9	118	111.6	38.4	178	168.3	58.0	238	225.0	77.5	298	281.8	97.0
59	55.8	19.2	119	112.5	38.7	179	169.2	58.3	239	226.0	77.8	299	282.7	97.3
60	56.7	19.5	120	113.5	39.1	180	170.2	58.6	240	226.9	78.1	300	283.7	97.7
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 71 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 20 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.3	61	57.3	20.9	121	113.7	41.4	181	170.1	61.9	241	226.5	82.4
2	01.9	00.7	62	58.3	21.2	122	114.6	41.7	182	171.0	62.2	242	227.4	82.8
3	02.8	01.0	63	59.2	21.5	123	115.6	42.1	183	172.0	62.6	243	228.3	83.1
4	03.8	01.4	64	60.1	21.9	124	116.5	42.4	184	172.9	62.9	244	229.3	83.5
5	04.7	01.7	65	61.1	22.2	125	117.5	42.8	185	173.8	63.3	245	230.2	83.8
6	05.6	02.1	66	62.0	22.6	126	118.4	43.1	186	174.8	63.6	246	231.2	84.2
7	06.6	02.4	67	63.0	22.9	127	119.3	43.4	187	175.7	64.0	247	232.1	84.5
8	07.5	02.7	68	63.9	23.3	128	120.3	43.8	188	176.7	64.3	248	233.0	84.8
9	08.5	03.1	69	64.8	23.6	129	121.2	44.1	189	177.6	64.6	249	234.0	85.2
10	09.4	03.4	70	65.8	23.9	130	122.2	44.5	190	178.5	65.0	250	234.9	85.5
11	10.3	03.8	71	66.7	24.3	131	123.1	44.8	191	179.5	65.3	251	235.9	85.8
12	11.3	04.1	72	67.7	24.6	132	124.0	45.1	192	180.4	65.7	252	236.8	86.2
13	12.2	04.4	73	68.6	25.0	133	125.0	45.5	193	181.4	66.0	253	237.7	86.5
14	13.2	04.8	74	69.5	25.3	134	125.9	45.8	194	182.3	66.4	254	238.7	86.9
15	14.1	05.1	75	70.5	25.7	135	126.9	46.2	195	183.2	66.7	255	239.6	87.2
16	15.0	05.5	76	71.4	26.0	136	127.8	46.5	196	184.2	67.0	256	240.6	87.6
17	16.0	05.8	77	72.4	26.3	137	128.7	46.9	197	185.1	67.4	257	241.5	87.9
18	16.9	06.2	78	73.3	26.7	138	129.7	47.2	198	186.1	67.7	258	242.4	88.2
19	17.9	06.5	79	74.2	27.0	139	130.6	47.5	199	187.0	68.1	259	243.4	88.6
20	18.8	06.8	80	75.2	27.4	140	131.6	47.9	200	187.9	68.4	260	244.3	88.9
21	19.7	07.2	81	76.1	27.7	141	132.5	48.2	201	188.9	68.7	261	245.3	89.3
22	20.7	07.5	82	77.1	28.0	142	133.4	48.6	202	189.8	69.1	262	246.2	89.6
23	21.6	07.9	83	78.0	28.4	143	134.4	48.9	203	190.8	69.4	263	247.1	90.0
24	22.6	08.2	84	78.9	28.7	144	135.3	49.3	204	191.7	69.8	264	248.1	90.3
25	23.5	08.6	85	79.9	29.1	145	136.3	49.6	205	192.6	70.1	265	249.0	90.6
26	24.4	08.9	86	80.8	29.4	146	137.2	49.9	206	193.6	70.5	266	250.0	91.0
27	25.4	09.2	87	81.8	29.8	147	138.1	50.3	207	194.5	70.8	267	250.9	91.3
28	26.3	09.6	88	82.7	30.1	148	139.1	50.6	208	195.5	71.1	268	251.8	91.7
29	27.3	09.9	89	83.6	30.4	149	140.0	51.0	209	196.4	71.5	269	252.8	92.0
30	28.2	10.3	90	84.6	30.8	150	141.0	51.3	210	197.3	71.8	270	253.7	92.3
31	29.1	10.6	91	85.5	31.1	151	141.9	51.6	211	198.3	72.2	271	254.7	92.7
32	30.1	10.9	92	86.5	31.5	152	142.8	52.0	212	199.2	72.5	272	255.6	93.0
33	31.0	11.3	93	87.4	31.8	153	143.8	52.3	213	200.2	72.9	273	256.5	93.4
34	31.9	11.6	94	88.3	32.1	154	144.7	52.7	214	201.1	73.2	274	257.5	93.7
35	32.9	12.0	95	89.3	32.5	155	145.7	53.0	215	202.0	73.5	275	258.4	94.1
36	33.8	12.3	96	90.2	32.8	156	146.6	53.4	216	203.0	73.9	276	259.4	94.4
37	34.8	12.7	97	91.2	33.2	157	147.5	53.7	217	203.9	74.2	277	260.3	94.7
38	35.7	13.0	98	92.1	33.5	158	148.5	54.0	218	204.9	74.6	278	261.2	95.1
39	36.6	13.3	99	93.0	33.9	159	149.4	54.4	219	205.8	74.9	279	262.2	95.4
40	37.6	13.7	100	94.0	34.2	160	150.4	54.7	220	206.7	75.2	280	263.1	95.8
41	38.5	14.0	101	94.9	34.5	161	151.3	55.1	221	207.7	75.6	281	264.1	96.1
42	39.5	14.4	102	95.8	34.9	162	152.2	55.4	222	208.6	75.9	282	265.0	96.4
43	40.4	14.7	103	96.8	35.2	163	153.2	55.7	223	209.6	76.3	283	265.9	96.8
44	41.3	15.0	104	97.7	35.6	164	154.1	56.1	224	210.5	76.6	284	266.9	97.1
45	42.3	15.4	105	98.7	35.9	165	155.0	56.4	225	211.4	77.0	285	267.8	97.5
46	43.2	15.7	106	99.6	36.3	166	156.0	56.8	226	212.4	77.3	286	268.8	97.8
47	44.2	16.1	107	100.5	36.6	167	156.9	57.1	227	213.3	77.6	287	269.7	98.2
48	45.1	16.4	108	101.5	36.9	168	157.9	57.5	228	214.2	78.0	288	270.6	98.5
49	46.0	16.8	109	102.4	37.3	169	158.8	57.8	229	215.2	78.3	289	271.6	98.8
50	47.0	17.1	110	103.4	37.6	170	159.7	58.1	230	216.1	78.7	290	272.5	99.2
51	47.9	17.4	111	104.3	38.0	171	160.7	58.5	231	217.1	79.0	291	273.5	99.5
52	48.9	17.8	112	105.2	38.3	172	161.6	58.8	232	218.0	79.3	292	274.4	99.9
53	49.8	18.1	113	106.2	38.6	173	162.6	59.2	233	218.9	79.7	293	275.3	100.2
54	50.7	18.5	114	107.1	39.0	174	163.5	59.5	234	219.9	80.0	294	276.3	100.6
55	51.7	18.8	115	108.1	39.3	175	164.4	59.9	235	220.8	80.4	295	277.2	100.9
56	52.6	19.2	116	109.0	39.7	176	165.4	60.2	236	221.8	80.7	296	278.1	101.2
57	53.6	19.5	117	109.9	40.0	177	166.3	60.5	237	222.7	81.1	297	279.1	101.6
58	54.5	19.8	118	110.9	40.4	178	167.3	60.9	238	223.6	81.4	298	280.0	101.9
59	55.4	20.2	119	111.8	40.7	179	168.2	61.2	239	224.6	81.7	299	281.0	102.3
60	56.4	20.5	120	112.8	41.0	180	169.1	61.6	240	225.5	82.1	300	281.9	102.6
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 70 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 21 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.4	61	56.9	21.9	121	113.0	43.4	181	169.0	64.9	241	225.0	86.4
2	01.9	00.7	62	57.9	22.2	122	113.9	43.7	182	169.9	65.2	242	225.9	86.7
3	02.8	01.1	63	58.8	22.6	123	114.8	44.1	183	170.8	65.6	243	226.9	87.1
4	03.7	01.4	64	59.7	22.9	124	115.8	44.4	184	171.8	65.9	244	227.8	87.4
5	04.7	01.8	65	60.7	23.3	125	116.7	44.8	185	172.7	66.3	245	228.7	87.8
6	05.6	02.2	66	61.6	23.7	126	117.6	45.2	186	173.6	66.7	246	229.7	88.2
7	06.5	02.5	67	62.5	24.0	127	118.6	45.5	187	174.6	67.0	247	230.6	88.5
8	07.5	02.9	68	63.5	24.4	128	119.5	45.9	188	175.5	67.4	248	231.5	88.9
9	08.4	03.2	69	64.4	24.7	129	120.4	46.2	189	176.4	67.7	249	232.5	89.2
10	09.3	03.6	70	65.4	25.1	130	121.4	46.6	190	177.4	68.1	250	233.4	89.6
11	10.3	03.9	71	66.3	25.4	131	122.3	46.9	191	178.3	68.4	251	234.3	90.0
12	11.2	04.3	72	67.2	25.8	132	123.2	47.3	192	179.2	68.8	252	235.3	90.3
13	12.1	04.7	73	68.2	26.2	133	124.2	47.7	193	180.2	69.2	253	236.2	90.7
14	13.1	05.0	74	69.1	26.5	134	125.1	48.0	194	181.1	69.5	254	237.1	91.0
15	14.0	05.4	75	70.0	26.9	135	126.0	48.4	195	182.0	69.9	255	238.1	91.4
16	14.9	05.7	76	71.0	27.2	136	127.0	48.7	196	183.0	70.2	256	239.0	91.7
17	15.9	06.1	77	71.9	27.6	137	127.9	49.1	197	183.9	70.6	257	239.9	92.1
18	16.8	06.5	78	72.8	28.0	138	128.8	49.5	198	184.8	71.0	258	240.9	92.5
19	17.7	06.8	79	73.8	28.3	139	129.8	49.8	199	185.8	71.3	259	241.8	92.8
20	18.7	07.2	80	74.7	28.7	140	130.7	50.2	200	186.7	71.7	260	242.7	93.2
21	19.6	07.5	81	75.6	29.0	141	131.6	50.5	201	187.6	72.0	261	243.7	93.5
22	20.5	07.9	82	76.6	29.4	142	132.6	50.9	202	188.6	72.4	262	244.6	93.9
23	21.5	08.2	83	77.5	29.7	143	133.5	51.2	203	189.5	72.7	263	245.5	94.3
24	22.4	08.6	84	78.4	30.1	144	134.4	51.6	204	190.4	73.1	264	246.5	94.6
25	23.3	09.0	85	79.4	30.5	145	135.4	52.0	205	191.4	73.5	265	247.4	95.0
26	24.3	09.3	86	80.3	30.8	146	136.3	52.3	206	192.3	73.8	266	248.3	95.3
27	25.2	09.7	87	81.2	31.2	147	137.2	52.7	207	193.3	74.2	267	249.3	95.7
28	26.1	10.0	88	82.2	31.5	148	138.2	53.0	208	194.2	74.5	268	250.2	96.0
29	27.1	10.4	89	83.1	31.9	149	139.1	53.4	209	195.1	74.9	269	251.1	96.4
30	28.0	10.8	90	84.0	32.3	150	140.0	53.8	210	196.1	75.3	270	252.1	96.8
31	28.9	11.1	91	85.0	32.6	151	141.0	54.1	211	197.0	75.6	271	253.0	97.1
32	29.9	11.5	92	85.9	33.0	152	141.9	54.5	212	197.9	76.0	272	253.9	97.5
33	30.8	11.8	93	86.8	33.3	153	142.8	54.8	213	198.9	76.3	273	254.9	97.8
34	31.7	12.2	94	87.8	33.7	154	143.8	55.2	214	199.8	76.7	274	255.8	98.2
35	32.7	12.5	95	88.7	34.0	155	144.7	55.5	215	200.7	77.0	275	256.7	98.6
36	33.6	12.9	96	89.6	34.4	156	145.6	55.9	216	201.7	77.4	276	257.7	98.9
37	34.5	13.3	97	90.6	34.8	157	146.6	56.3	217	202.6	77.8	277	258.6	99.3
38	35.5	13.6	98	91.5	35.1	158	147.5	56.6	218	203.5	78.1	278	259.5	99.6
39	36.4	14.0	99	92.4	35.5	159	148.4	57.0	219	204.5	78.5	279	260.5	100.0
40	37.3	14.3	100	93.4	35.8	160	149.4	57.3	220	205.4	78.8	280	261.4	100.3
41	38.3	14.7	101	94.3	36.2	161	150.3	57.7	221	206.3	79.2	281	262.3	100.7
42	39.2	15.1	102	95.2	36.6	162	151.2	58.1	222	207.3	79.6	282	263.3	101.1
43	40.1	15.4	103	96.2	36.9	163	152.2	58.4	223	208.2	79.9	283	264.2	101.4
44	41.1	15.8	104	97.1	37.3	164	153.1	58.8	224	209.1	80.3	284	265.1	101.8
45	42.0	16.1	105	98.0	37.6	165	154.0	59.1	225	210.1	80.6	285	266.1	102.1
46	42.9	16.5	106	99.0	38.0	166	155.0	59.5	226	211.0	81.0	286	267.0	102.5
47	43.9	16.8	107	99.9	38.3	167	155.9	59.8	227	211.9	81.3	287	267.9	102.9
48	44.8	17.2	108	100.8	38.7	168	156.8	60.2	228	212.9	81.7	288	268.9	103.2
49	45.7	17.6	109	101.8	39.1	169	157.8	60.6	229	213.8	82.1	289	269.8	103.6
50	46.7	17.9	110	102.7	39.4	170	158.7	60.9	230	214.7	82.4	290	270.7	103.9
51	47.6	18.3	111	103.6	39.8	171	159.6	61.3	231	215.7	82.8	291	271.7	104.3
52	48.5	18.6	112	104.6	40.1	172	160.6	61.6	232	216.6	83.1	292	272.6	104.6
53	49.5	19.0	113	105.5	40.5	173	161.5	62.0	233	217.5	83.5	293	273.5	105.0
54	50.4	19.4	114	106.4	40.9	174	162.4	62.4	234	218.5	83.9	294	274.5	105.4
55	51.3	19.7	115	107.4	41.2	175	163.4	62.7	235	219.4	84.2	295	275.4	105.7
56	52.3	20.1	116	108.3	41.6	176	164.3	63.1	236	220.3	84.6	296	276.3	106.1
57	53.2	20.4	117	109.2	41.9	177	165.2	63.4	237	221.3	84.9	297	277.3	106.4
58	54.1	20.8	118	110.2	42.3	178	166.2	63.8	238	222.2	85.3	298	278.2	106.8
59	55.1	21.1	119	111.1	42.6	179	167.1	64.1	239	223.1	85.6	299	279.1	107.2
60	56.0	21.5	120	112.0	43.0	180	168.0	64.5	240	224.1	86.0	300	280.1	107.5
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 69 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 22 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.4	61	56.6	22.9	121	112.2	45.3	181	167.8	67.8	241	223.5	90.3
2	01.9	00.7	62	57.5	23.2	122	113.1	45.7	182	168.7	68.2	242	224.4	90.7
3	02.8	01.1	63	58.4	23.6	123	114.0	46.1	183	169.7	68.6	243	225.3	91.0
4	03.7	01.5	64	59.3	24.0	124	115.0	46.5	184	170.6	68.9	244	226.2	91.4
5	04.6	01.9	65	60.3	24.3	125	115.9	46.8	185	171.5	69.3	245	227.2	91.8
6	05.6	02.2	66	61.2	24.7	126	116.8	47.2	186	172.5	69.7	246	228.1	92.2
7	06.5	02.6	67	62.1	25.1	127	117.8	47.6	187	173.4	70.1	247	229.0	92.5
8	07.4	03.0	68	63.0	25.5	128	118.7	47.9	188	174.3	70.4	248	229.9	92.9
9	08.3	03.4	69	64.0	25.8	129	119.6	48.3	189	175.2	70.8	249	230.9	93.3
10	09.3	03.7	70	64.9	26.2	130	120.5	48.7	190	176.2	71.2	250	231.8	93.7
11	10.2	04.1	71	65.8	26.6	131	121.5	49.1	191	177.1	71.5	251	232.7	94.0
12	11.1	04.5	72	66.8	27.0	132	122.4	49.4	192	178.0	71.9	252	233.7	94.4
13	12.1	04.9	73	67.7	27.3	133	123.3	49.8	193	178.9	72.3	253	234.6	94.8
14	13.0	05 2	74	68.6	27.7	134	124.2	50.2	194	179.9	72.7	254	235.5	95.2
15	13.9	05.6	75	69.5	28.1	135	125.2	50.6	195	180.8	73.0	255	236.4	95.5
16	14.8	06.0	76	70.5	28.5	136	126.1	50.9	196	181.7	73.4	256	237.4	95.9
17	15.8	06.4	77	71.4	28.8	137	127.0	51.3	197	182.7	73.8	257	238.3	96.3
18	16.7	06.7	78	72.3	29.2	138	128.0	51.7	198	183.6	74.2	258	239.2	96.6
19	17.6	07.1	79	73.2	29.6	139	128.9	52.1	199	184.5	74.5	259	240.1	97.0
20	18.5	07.5	80	74.2	30.0	140	129.8	52.4	200	185.4	74.9	260	241.1	97.4
21	19.5	07.9	81	75.1	30.3	141	130.7	52.8	201	186.4	75.3	261	242.0	97.8
22	20.4	08.2	82	76.0	30.7	142	131.7	53 2	202	187.3	75.7	262	242.9	98.1
23	21.3	08.6	83	77.0	31.1	143	132.6	53.6	203	188.2	76.0	263	243.8	98.5
24	22.3	09.0	84	77.9	31.5	144	133.5	53.9	204	189.1	76.4	264	244.8	98.9
25	23.2	09.4	85	78.8	31.8	145	134.4	54.3	205	190.1	76 8	265	245.7	99.3
26	24.1	09.7	86	79.7	32.2	146	135.4	54.7	206	191.0	77.2	266	246.6	99.6
27	25.0	10.1	87	80.7	32.6	147	136.3	55.1	207	191.9	77.5	267	247 6	100.0
28	26.0	10.5	88	81.6	33.0	148	137.2	55.4	208	192.9	77.9	268	248.5	100.4
29	26.9	10.9	89	82.5	33.3	149	138.2	55.8	209	193.8	78.3	269	249.4	100.8
30	27.8	11.2	90	83.4	33.7	150	139.1	56.2	210	194.7	78.7	270	250.3	101.1
31	28.7	11.6	91	84.4	34.1	151	140.0	56.6	211	195.6	79.0	271	251.3	101.5
32	29.7	12.0	92	85.3	34.5	152	140.9	56.9	212	196.6	79.4	272	252.2	101.9
33	30.6	12.4	93	86.2	34.8	153	141.9	57.3	213	197.5	79.8	273	253.1	102.3
34	31.5	12.7	94	87.2	35.2	154	142.8	57.7	214	198.4	80.2	274	254.0	102.6
35	32.5	13.1	95	88.1	35.6	155	143.7	58.1	215	199.3	80.5	275	255.0	103.0
36	33.4	13.5	96	89.0	36.0	156	144.6	58.4	216	200.3	80.9	276	255.9	103.4
37	34.3	13.9	97	89.9	36.3	157	145.6	58.8	217	201.2	81.3	277	256.8	103.8
38	35.2	14.2	98	90.9	36.7	158	146.5	59.2	218	202.1	81.7	278	257.8	104.1
39	36.2	14.6	99	91.8	37.1	159	147.4	59.6	219	203.1	82.0	279	258.7	104 5
40	37.1	15.0	100	92.7	37.5	160	148.3	59 9	220	204.0	82.4	280	259.6	104.9
41	38.0	15.4	101	93.6	37.8	161	149.3	60.3	221	204.9	82.8	281	260.5	105.3
42	38.9	15.7	102	94.6	38.2	162	150.2	60.7	222	205.8	83.2	282	261.5	105.6
43	39.9	16.1	103	95.5	38.6	163	151.1	61.1	223	206.8	83.5	283	262.4	106.0
44	40.8	16.5	104	96.4	39.0	164	152.1	61.4	224	207.7	83.9	284	263.3	106.4
45	41.7	16.9	105	97.4	39.3	165	153.0	61.8	225	208.6	84.3	285	264.2	106.8
46	42.7	17.2	106	98.3	39.7	166	153.9	62.2	226	209.5	84.7	286	265.2	107.1
47	43.6	17.6	107	99.2	40.1	167	154.8	62.6	227	210.5	85.0	287	266.1	107.5
48	44.5	18.0	108	100.1	40.5	168	155.8	62.9	228	211.4	85.4	288	267.0	107.9
49	45.4	18.4	109	101.1	40.8	169	156.7	63.3	229	212.3	85.8	289	268.0	108.3
50	46.4	18.7	110	102.0	41.2	170	157.6	63.7	230	213.3	86.2	290	268.9	108.6
51	47.3	19.1	111	102.9	41.6	171	158.5	64.1	231	214.2	86.5	291	269.8	109.0
52	48.2	19.5	112	103.8	42.0	172	159.5	64.4	232	215.1	86.9	292	270.7	109.4
53	49.1	19.9	113	104.8	42.3	173	160.4	64.8	233	216.0	87.3	293	271.7	109.8
54	50.1	20.2	114	105.7	42.7	174	161.3	65.2	234	217.0	87.7	294	272.6	110.1
55	51.0	20.6	115	106.6	43.1	175	162.3	65.6	235	217.9	88.0	295	273.5	110.5
56	51.9	21.0	116	107.6	43.5	176	163.2	65.9	236	218.8	88.4	296	274.4	110.9
57	52.8	21.4	117	108.5	43.8	177	164.1	66.3	237	219.7	88.8	297	275.4	111.3
58	53.8	21.7	118	109.4	44.2	178	165.0	66.7	238	220.7	89.2	298	276.3	111.6
59	54.7	22.1	119	110.3	44.6	179	166.0	67.1	239	221.6	89.5	299	277.2	112.0
60	55.6	22.5	120	111.3	45.0	180	166.9	67.4	240	222.5	89.9	300	278.2	112.4
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 68 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 23 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.4	61	56 2	23.8	121	111.4	47.3	181	166.6	70.7	241	221.8	94.2
2	01.8	00.8	62	57.1	24.2	122	112.3	47.7	182	167.5	71.1	242	222.8	94.5
3	02.8	01.2	63	58.0	24.6	123	113.2	48.1	183	168.5	71.5	243	223.7	94.9
4	03.7	01.6	64	58.9	25.0	124	114.1	48.5	184	169.4	71.9	244	224.6	95.3
5	04.6	02.0	65	59.8	25.4	125	115.1	48.8	185	170.3	72.3	245	225.5	95 7
6	05.5	02.3	66	60.8	25.8	126	116.0	49.2	186	171 2	72.7	246	226.4	96.1
7	06.4	02.7	67	61.7	26.2	127	116.9	49.6	187	172.1	73.1	247	227.4	96.5
8	07.4	03.1	68	62.6	26.6	128	117.8	50.0	188	173.1	73.5	248	228 3	96.9
9	08.3	03.5	69	63.5	27.0	129	118.7	50.4	189	174.0	73.8	249	229.2	97.3
10	09 2	03.9	70	64.4	27.4	130	119.7	50.8	190	174 9	74.2	250	230.1	97.7
11	10.1	04.3	71	65.4	27.7	131	120 6	51.2	191	175.8	74.6	251	231.0	98.1
12	11.0	04.7	72	66.3	28.1	132	121.5	51.6	192	176.7	75.0	252	232.0	98.5
13	12.0	05.1	73	67.2	28.5	133	122.4	52.0	193	177.7	75 4	253	232.9	98.9
14	12.9	05.5	74	68.1	28.9	134	123.3	52 4	194	178.6	75.8	254	233.8	99.2
15	13.8	05.9	75	69.0	29.3	135	124.3	52.7	195	179 5	76.2	255	234 7	99.6
16	14.7	06.3	76	70.0	29.7	136	125.2	53.1	196	180.4	76.6	256	235.6	100.0
17	15.6	06.6	77	70 9	30.1	137	126.1	53.5	197	181.3	77 0	257	236.6	100.4
18	16.6	07.0	78	71.8	30.5	138	127.0	53.9	198	182.3	77.4	258	237.5	100.8
19	17.5	07.4	79	72.7	30 9	139	128.0	54.3	199	183.2	77.8	259	238.4	101.2
20	18.4	07.8	80	73.6	31.3	140	128.9	54.7	200	184.1	78.1	260	239.3	101.6
21	19.3	08.2	81	74.6	31.6	141	129.8	55.1	201	185.0	78.5	261	240.3	102.0
22	20 3	08 6	82	75.5	32.0	142	130.7	55.5	202	185.9	78.9	262	241.2	102.4
23	21.2	09.0	83	76.4	32.4	143	131.6	55.9	203	186.9	79.3	263	242.1	102.8
24	22.1	09.4	84	77.3	32 8	144	132.6	56.3	204	187.8	79.7	264	243.0	103.2
25	23.0	09.8	85	78.2	33.2	145	133.5	56.7	205	188.7	80.1	265	243.9	103.5
26	23.9	10.2	86	79.2	33.6	146	134 4	57.0	206	189.6	80.5	266	244.9	103.9
27	24.9	10.5	87	80.1	34.0	147	135.3	57.4	207	190.5	80.9	267	245.8	104.3
28	25.8	10.9	88	81.0	34.4	148	136.2	57.8	208	191.5	81.3	268	246.7	104 7
29	26.7	11.3	89	81.9	34.8	149	137.2	58.2	209	192.4	81.7	269	247.6	105.1
30	27.6	11.7	90	82.8	35.2	150	138.1	58.6	210	193.3	82.1	270	248.5	105.5
31	28.5	12.1	91	83.8	35.6	151	139.0	59.0	211	194.2	82.4	271	249.5	105.9
32	29.5	12.5	92	84.7	35.9	152	139.9	59.4	212	195.1	82.8	272	250.4	106.3
33	30.4	12.9	93	85.6	36.3	153	140.8	59.8	213	196.1	83.2	273	251.3	106.7
34	31.3	13.3	94	86.5	36.7	154	141 8	60.2	214	197 0	83.6	274	252.2	107.1
35	32.2	13.7	95	87.4	37.1	155	142.7	60.6	215	197.9	84.0	275	253.1	107.5
36	33.1	14.1	96	88.4	37.5	156	143.6	61.0	216	198.8	84.4	276	254.1	107.8
37	34.1	14.5	97	89.3	37.9	157	144.5	61 3	217	199.7	84.8	277	255.0	108.2
38	35.0	14.8	98	90.2	38.3	158	145.4	61.7	218	200.7	85.2	278	255.9	108.6
39	35.9	15.2	99	91.1	38.7	159	146.4	62.1	219	201.6	85.6	279	256.8	109.0
40	36.8	15.6	100	92.1	39.1	160	147.3	62.5	220	202.5	86.0	280	257.7	109.4
41	37.7	16.0	101	93.0	39.5	161	148.2	62 9	221	203.4	86.4	281	258.7	109.8
42	38.7	16.4	102	93.9	39.9	162	149.1	63.3	222	204.4	86.7	282	259.6	110.2
43	39 6	16.8	103	94.8	40.2	163	150.0	63.7	223	205.3	87.1	283	260.5	110.6
44	40.5	17.2	104	95.7	40.6	164	151.0	64.1	224	206.2	87.5	284	261.4	111.0
45	41.4	17.6	105	96.7	41.0	165	151.9	64.5	225	207.1	87.9	285	262.3	111.4
46	42.3	18.0	106	97.6	41.4	166	152.8	64 9	226	208.0	88.3	286	263.3	111.7
47	43.3	18.4	107	98.5	41.8	167	153 7	65.3	227	209.0	88.7	287	264.2	112.1
48	44.2	18.8	108	99.4	42.2	168	154.6	65.6	228	209.9	89.1	288	265.1	112.5
49	45.1	19.1	109	100.3	42.6	169	155.6	66.0	229	210.8	89.5	289	266.0	112.9
50	46.0	19.5	110	101.3	43.0	170	156.5	66.4	230	211.7	89.9	290	266.9	113.3
51	46.9	19.9	111	102.2	43.4	171	157.4	66.8	231	212.6	90.3	291	267.9	113.7
52	47.9	20.3	112	103.1	43 8	172	158.3	67.2	232	213.6	90.6	292	268.8	114.1
53	48.8	20.7	113	104.0	44.2	173	159.2	67.6	233	214.5	91.0	293	269.7	114.5
54	49.7	21.1	114	104.9	44.5	174	160.2	68.0	234	215.4	91.4	294	270.6	114.9
55	50.6	21.5	115	105.9	44.9	175	161.1	68.4	235	216.3	91.8	295	271.5	115.3
56	51.5	21.9	116	106.8	45.3	176	162.0	68.8	236	217.2	92.2	296	272.5	115.7
57	52.5	22.3	117	107.7	45.7	177	162.9	69.2	237	218.2	92.6	297	273.4	116.0
58	53.4	22.7	118	108.6	46.1	178	163.8	69.6	238	219.1	93.0	298	274.3	116.4
59	54.3	23.1	119	109.5	46.5	179	164.8	69.9	239	220.0	93.4	299	275.2	116.8
60	55.2	23.4	120	110.5	46.9	180	165.7	70.3	240	220.9	93.8	300	276.2	117.2
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 67 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 24 DEGREES.

Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.4	61	55.7	24.8	121	110.5	49.2	181	165.4	73.6	241	220.2	98.0
2	01.8	00.8	62	56.6	25.2	122	111.5	49.6	182	166.3	74.0	242	221.1	98.4
3	02.7	01.2	63	57.6	25.6	123	112.4	50.0	183	167.2	74.4	243	222.0	98.8
4	03.7	01.6	64	58.5	26.0	124	113.3	50.4	184	168.1	74.8	244	222.9	99.2
5	04.6	02.0	65	59.4	26.4	125	114.2	50.8	185	169.0	75.2	245	223.8	99.7
6	05.5	02.4	66	60.3	26.8	126	115.1	51.1	186	169.9	75.7	246	224.7	100.1
7	06.4	02.8	67	61.2	27.3	127	116.0	51.7	187	170.8	76.1	247	225.6	100.5
8	07.3	03.3	68	62.1	27.7	128	116.9	52.1	188	171.7	76.5	248	226.6	100.9
9	08.2	03.7	69	63.0	28.1	129	117.8	52.5	189	172.7	76.9	249	227.5	101.3
10	09.1	04.1	70	63.9	28.5	130	118.8	52.9	190	173.6	77.3	250	228.4	101.7
11	10.0	04.5	71	64.9	28.9	131	119.7	53.3	191	174.5	77.7	251	229.3	102.1
12	11.0	04.9	72	65.8	29.3	132	120.6	53.7	192	175.4	78.1	252	230.2	102.5
13	11.9	05.3	73	66.7	29.7	133	121.5	54.1	193	176.3	78.5	253	231.1	102.9
14	12.8	05.7	74	67.6	30.1	134	122.4	54.5	194	177.2	78.9	254	232.0	103.3
15	13.7	06.1	75	68.5	30.5	135	123.3	54.9	195	178.1	79.3	255	233.0	103.7
16	14.6	06.5	76	69.4	30.9	136	124.2	55.3	196	179.1	79.7	256	233.9	104.1
17	15.5	06.9	77	70.3	31.3	137	125.2	55.7	197	180.0	80.1	257	234.8	104.5
18	16.4	07.3	78	71.3	31.7	138	126.1	56.1	198	180.9	80.5	258	235.7	104.9
19	17.4	07.7	79	72.2	32.1	139	127.0	56.5	199	181.8	80.9	259	236.6	105.3
20	18.3	08.1	80	73.1	32.5	140	127.9	56.9	200	182.7	81.3	260	237.5	105.8
21	19.2	08.5	81	74.0	32.9	141	128.8	57.3	201	183.6	81.8	261	238.4	106.2
22	20.1	08.9	82	74.9	33.4	142	129.7	57.8	202	184.5	82.2	262	239.3	106.6
23	21.0	09.4	83	75.8	33.8	143	130.6	58.2	203	185.4	82.6	263	240.3	107.0
24	21.9	09.8	84	76.7	34.2	144	131.6	58.6	204	186.4	83.0	264	241.2	107.4
25	22.8	10.2	85	77.7	34.6	145	132.5	59.0	205	187.3	83.4	265	242.1	107.8
26	23.8	10.6	86	78.6	35.0	146	133.4	59.4	206	188.2	83.8	266	243.0	108.2
27	24.7	11.0	87	79.5	35.4	147	134.3	59.8	207	189.1	84.2	267	243.9	108.6
28	25.6	11.4	88	80.4	35.8	148	135.2	60.2	208	190.0	84.6	268	244.8	109.0
29	26.5	11.8	89	81.3	36.2	149	136.1	60.6	209	190.9	85.0	269	245.7	109.4
30	27.4	12.2	90	82.2	36.6	150	137.0	61.0	210	191.8	85.4	270	246.7	109.8
31	28.3	12.6	91	83.1	37.0	151	137.9	61.4	211	192.8	85.8	271	247.6	110.2
32	29.2	13.0	92	84.0	37.4	152	138.9	61.8	212	193.7	86.2	272	248.5	110.6
33	30.1	13.4	93	85.0	37.8	153	139.8	62.2	213	194.6	86.6	273	249.4	111.0
34	31.1	13.8	94	85.9	38.2	154	140.7	62.6	214	195.5	87.0	274	250.3	111.4
35	32.0	14.2	95	86.8	38.6	155	141.6	63.0	215	196.4	87.4	275	251.2	111.9
36	32.9	14.6	96	87.7	39.0	156	142.5	63.5	216	197.3	87.9	276	252.1	112.3
37	33.8	15.0	97	88.6	39.5	157	143.4	63.9	217	198.2	88.3	277	253.1	112.7
38	34.7	15.5	98	89.5	39.9	158	144.3	64.3	218	199.2	88.7	278	254.0	113.1
39	35.6	15.9	99	90.4	40.3	159	145.3	64.7	219	200.1	89.1	279	254.9	113.5
40	36.5	16.3	100	91.4	40.7	160	146.2	65.1	220	201.0	89.5	280	255.8	113.9
41	37.5	16.7	101	92.3	41.1	161	147.1	65.5	221	201.9	89.9	281	256.7	114.3
42	38.4	17.1	102	93.2	41.5	162	148.0	65.9	222	202.8	90.3	282	257.6	114.7
43	39.3	17.5	103	94.1	41.9	163	148.9	66.3	223	203.7	90.7	283	258.5	115.1
44	40.2	17.9	104	95.0	42.3	164	149.8	66.7	224	204.6	91.1	284	259.4	115.5
45	41.1	18.3	105	95.9	42.7	165	150.7	67.1	225	205.5	91.5	285	260.4	115.9
46	42.0	18.7	106	96.8	43.1	166	151.6	67.5	226	206.5	91.9	286	261.3	116.3
47	42.9	19.1	107	97.7	43.5	167	152.6	67.9	227	207.4	92.3	287	262.2	116.7
48	43.9	19.5	108	98.7	43.9	168	153.5	68.3	228	208.3	92.7	288	263.1	117.1
49	44.8	19.9	109	99.6	44.3	169	154.4	68.7	229	209.2	93.1	289	264.0	117.5
50	45.7	20.3	110	100.5	44.7	170	155.3	69.1	230	210.1	93.5	290	264.9	118.0
51	46.6	20.7	111	101.4	45.1	171	156.2	69.6	231	211.0	94.0	291	265.8	118.4
52	47.5	21.2	112	102.3	45.6	172	157.1	70.0	232	211.9	94.4	292	266.8	118.8
53	48.4	21.6	113	103.2	46.0	173	158.0	70.4	233	212.9	94.8	293	267.7	119.2
54	49.3	22.0	114	104.1	46.4	174	159.0	70.8	234	213.8	95.2	294	268.6	119.6
55	50.2	22.4	115	105.1	46.8	175	159.9	71.2	235	214.7	95.6	295	269.5	120.0
56	51.2	22.8	116	106.0	47.2	176	160.8	71.6	236	215.6	96.0	296	270.4	120.4
57	52.1	23.2	117	106.9	47.6	177	161.7	72.0	237	216.5	96.4	297	271.3	120.8
58	53.0	23.6	118	107.8	48.0	178	162.6	72.4	238	217.4	96.8	298	272.2	121.2
59	53.9	24.0	119	108.7	48.4	179	163.5	72.8	239	218.3	97.2	299	273.2	121.6
60	54.8	24.4	120	109.6	48.8	180	164.4	73.2	240	219.3	97.6	300	274.1	122.0
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 66 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 25 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.4	61	55.3	25.8	121	109.7	51.1	181	164.0	76.5	241	218.4	101.9
2	01.8	00.8	62	56.2	26.2	122	110.6	51.6	182	164.9	76.9	242	219.3	102.3
3	02.7	01.3	63	57.1	26.6	123	111.5	52.0	183	165.9	77.3	243	220.2	102.7
4	03.6	01.7	64	58.0	27.0	124	112.4	52.4	184	166.8	77.8	244	221.1	103.1
5	04.5	02.1	65	58.9	27.5	125	113.3	52.8	185	167.7	78.2	245	222.0	103.5
6	05.4	02.5	66	59.8	27.9	126	114.2	53.2	186	168.6	78.6	246	223.0	104.0
7	06.3	03.0	67	60.7	28.3	127	115.1	53.7	187	169.5	79.0	247	223.9	104.4
8	07.3	03.4	68	61.6	28.7	128	116.0	54.1	188	170.4	79.5	248	224.8	104.8
9	08.2	03.8	69	62.5	29.2	129	116.9	54.5	189	171.3	79.9	249	225.7	105.2
10	09.1	04.2	70	63.4	29.6	130	117.8	54.9	190	172.2	80.3	250	226.6	105.7
11	10.0	04.6	71	64.3	30.0	131	118.7	55.4	191	173.1	80.7	251	227.5	106.1
12	10.9	05.1	72	65.3	30.4	132	119.6	55.8	192	174.0	81.1	252	228.4	106.5
13	11.8	05.5	73	66.2	30.9	133	120.5	56.2	193	174.9	81.6	253	229.3	106.9
14	12.7	05.9	74	67.1	31.3	134	121.4	56.6	194	175.8	82.0	254	230.2	107.3
15	13.6	06.3	75	68.0	31.7	135	122.4	57.1	195	176.7	82.4	255	231.1	107.8
16	14.5	06.8	76	68.9	32.1	136	123.3	57.5	196	177.6	82.8	256	232.0	108.2
17	15.4	07.2	77	69.8	32.5	137	124.2	57.9	197	178.5	83.3	257	232.9	108.6
18	16.3	07.6	78	70.7	33.0	138	125.1	58.3	198	179.4	83.7	258	233.8	109.4
19	17.2	08.0	79	71.6	33.4	139	126.0	58.7	199	180.4	84.1	259	234.7	109.5
20	18.1	08.5	80	72.5	33.8	140	126.9	59.2	200	181.3	84.5	260	235.6	109.9
21	19.0	08.9	81	73.4	34.2	141	127.8	59.6	201	182.2	84.9	261	236.5	110.3
22	19.9	09.3	82	74.3	34.7	142	128.7	60.0	202	183.1	85.4	262	237.5	110.7
23	20.8	09.7	83	75.2	35.1	143	129.6	60.4	203	184.0	85.8	263	238.4	111.1
24	21.8	10.1	84	76.1	35.5	144	130.5	60.9	204	184.9	86.2	264	239.3	111.6
25	22.7	10.6	85	77.0	35.9	145	131.4	61.3	205	185.8	86.6	265	240.2	112.0
26	23.6	11.0	86	77.9	36.3	146	132.3	61.7	206	186.7	87.1	266	241.1	112.4
27	24.5	11.4	87	78.8	36.8	147	133.2	62.1	207	187.6	87.5	267	242.0	112.8
28	25.4	11.8	88	79.8	37.2	148	134.1	62.5	208	188.5	87.9	268	242.9	113.3
29	26.3	12.3	89	80.7	37.6	149	135.0	63.0	209	189.4	88.3	269	243.8	113.7
30	27.2	12.7	90	81.6	38.0	150	135.9	63.4	210	190.3	88.7	270	244.7	114.1
31	28.1	13.1	91	82.5	38.5	151	136.9	63.8	211	191.2	89.2	271	245.6	114.5
32	29.0	13.5	92	83.4	38.9	152	137.8	64.2	212	192.1	89.6	272	246.5	115.0
33	29.9	13.9	93	84.3	39.3	153	138.7	64.7	213	193.0	90.0	273	247.4	115.4
34	30.8	14.4	94	85.2	39.7	154	139.6	65.1	214	193.9	90.4	274	248.3	115.8
35	31.7	14.8	95	86.1	40.1	155	140.5	65.5	215	194.9	90.9	275	249.2	116.2
36	32.6	15.2	96	87.0	40.6	156	141.4	65.9	216	195.8	91.3	276	250.1	116.6
37	33.5	15.6	97	87.9	41.0	157	142.3	66.4	217	196.7	91.7	277	251.0	117.1
38	34.4	16.1	98	88.8	41.4	158	143.2	66.8	218	197.6	92.1	278	252.0	117.5
39	35.3	16.5	99	89.7	41.8	159	144.1	67.2	219	198.5	92.6	279	252.9	117.9
40	36.3	16.9	100	90.6	42.3	160	145.0	67.6	220	199.4	93.0	280	253.8	118.3
41	37.2	17.3	101	91.5	42.7	161	145.9	68.0	221	200.3	93.4	281	254.7	118.8
42	38.1	17.7	102	92.4	43.1	162	146.8	68.5	222	201.2	93.8	282	255.6	119.2
43	39.0	18.2	103	93.3	43.5	163	147.7	68.9	223	202.1	94.2	283	256.5	119.6
44	39.9	18.6	104	94.3	44.0	164	148.6	69.3	224	203.0	94.7	284	257.4	120.0
45	40.8	19.0	105	95.2	44.4	165	149.5	69.7	225	203.9	95.1	285	258.3	120.4
46	41.7	19.4	106	96.1	44.8	166	150.4	70.2	226	204.8	95.5	286	259.2	120.9
47	42.6	19.9	107	97.0	45.2	167	151.4	70.6	227	205.7	95.9	287	260.1	121.3
48	43.5	20.3	108	97.9	45.6	168	152.3	71.0	228	206.6	96.4	288	261.0	121.7
49	44.4	20.7	109	98.8	46.1	169	153.2	71.4	229	207.5	96.8	289	261.9	122.1
50	45.3	21.1	110	99.7	46.5	170	154.1	71.8	230	208.5	97.2	290	262.8	122.6
51	46.2	21.6	111	100.6	46.9	171	155.0	72.3	231	209.4	97.6	291	263.7	123.0
52	47.1	22.0	112	101.5	47.3	172	155.9	72.7	232	210.3	98.0	292	264.6	123.4
53	48.0	22.4	113	102.4	47.8	173	156.8	73.1	233	211.2	98.5	293	265.5	123.8
54	48.9	22.8	114	103.3	48.2	174	157.7	73.5	234	212.1	98.9	294	266.5	124.2
55	49.8	23.2	115	104.2	48.6	175	158.6	74.0	235	213.0	99.3	295	267.4	124.7
56	50.8	23.7	116	105.1	49.0	176	159.5	74.4	236	213.9	99.7	296	268.3	125.1
57	51.7	24.1	117	106.0	49.4	177	160.4	74.8	237	214.8	100.2	297	269.2	125.5
58	52.6	24.5	118	106.9	49.9	178	161.3	75.2	238	215.7	100.6	298	270.1	125.9
59	53.5	24.9	119	107.9	50.3	179	162.2	75.6	239	216.6	101.0	299	271.0	126.4
60	54.4	25.4	120	108.8	50.7	180	163.1	76.1	240	217.5	101.4	300	271.9	126.8
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 65 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 26 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.4	61	54.8	26.7	121	108.8	53.0	181	162.7	79.3	241	216.6	105.6
2	01.8	00.9	62	55.7	27.2	122	109.7	53.5	182	163.6	79.8	242	217.5	106.1
3	02.7	01.3	63	56.6	27.6	123	110.6	53.9	183	164.5	80.2	243	218.4	106.5
4	03.6	01.8	64	57.5	28.1	124	111.5	54.4	184	165.4	80.7	244	219.3	107.0
5	04.5	02.2	65	58.4	28.5	125	112.3	54.8	185	166.3	81.1	245	220.2	107.4
6	05.4	02.6	66	59.3	28.9	126	113.2	55.2	186	167.2	81.5	246	221.1	107.8
7	06.3	03.1	67	60.2	29.4	127	114.1	55.7	187	168.1	82.0	247	222.0	108.3
8	07.2	03.5	68	61.1	29.8	128	115.0	56.1	188	169.0	82.4	248	222.9	108.7
9	08.1	03.9	69	62.0	30.2	129	115.9	56.5	189	169.9	82.9	249	223.8	109.2
10	09.0	04.4	70	62.9	30.7	130	116.8	57.0	190	170.8	83.3	250	224.7	109.6
11	09.9	04.8	71	63.8	31.1	131	117.7	57.4	191	171.7	83.7	251	225.6	110.0
12	10.8	05.3	72	64.7	31.6	132	118.6	57.9	192	172.6	84.2	252	226.5	110.5
13	11.7	05.7	73	65.6	32.0	133	119.5	58.3	193	173.5	84.6	253	227.4	110.9
14	12.6	06.1	74	66.5	32.4	134	120.4	58.7	194	174.4	85.0	254	228.3	111.3
15	13.5	06.6	75	67.4	32.9	135	121.3	59.2	195	175.3	85.5	255	229.2	111.8
16	14.4	07.0	76	68.3	33.3	136	122.2	59.6	196	176.2	85.9	256	230.1	112.2
17	15.3	07.5	77	69.2	33.8	137	123.1	60.1	197	177.1	86.4	257	231.0	112.7
18	16.2	07.9	78	70.1	34.2	138	124.0	60.5	198	178.0	86.8	258	231.9	113.1
19	17.1	08.3	79	71.0	34.6	139	124.9	60.9	199	178.9	87.2	259	232.8	113.5
20	18.0	08.8	80	71.9	35.1	140	125.8	61.4	200	179.8	87.7	260	233.7	114.0
21	18.9	09.2	81	72.8	35.5	141	126.7	61.8	201	180.7	88.1	261	234.6	114.4
22	19.8	09.6	82	73.7	35.9	142	127.6	62.2	202	181.6	88.6	262	235.5	114.9
23	20.7	10.1	83	74.6	36.4	143	128.5	62.7	203	182.5	89.0	263	236.4	115.3
24	21.6	10.5	84	75.5	36.8	144	129.4	63.1	204	183.4	89.4	264	237.3	115.7
25	22.5	11.0	85	76.4	37.3	145	130.3	63.6	205	184.3	89.9	265	238.2	116.2
26	23.4	11.4	86	77.3	37.7	146	131.2	64.0	206	185.2	90.3	266	239.1	116.6
27	24.3	11.8	87	78.2	38.1	147	132.1	64.4	207	186.1	90.7	267	240.0	117.0
28	25.2	12.3	88	79.1	38.6	148	133.0	64.9	208	186.9	91.2	268	240.9	117.5
29	26.1	12.7	89	80.0	39.0	149	133.9	65.3	209	187.8	91.6	269	241.8	117.9
30	27.0	13.2	90	80.9	39.5	150	134.8	65.8	210	188.7	92.1	270	242.7	118.4
31	27.9	13.6	91	81.8	39.9	151	135.7	66.2	211	189.6	92.5	271	243.6	118.8
32	28.8	14.0	92	82.7	40.3	152	136.6	66.6	212	190.5	92.9	272	244.5	119.2
33	29.7	14.5	93	83.6	40.8	153	137.5	67.1	213	191.4	93.4	273	245.4	119.7
34	30.6	14.9	94	84.5	41.2	154	138.4	67.5	214	192.3	93.8	274	246.3	120.1
35	31.5	15.3	95	85.4	41.6	155	139.3	67.9	215	193.2	94.2	275	247.2	120.6
36	32.4	15.8	96	86.3	42.1	156	140.2	68.4	216	194.1	94.7	276	248.1	121.0
37	33.3	16.2	97	87.2	42.5	157	141.1	68.8	217	195.0	95.1	277	249.0	121.4
38	34.2	16.7	98	88.1	43.0	158	142.0	69.3	218	195.9	95.6	278	249.9	121.9
39	35.1	17.1	99	89.0	43.4	159	142.9	69.7	219	196.8	96.0	279	250.8	122.3
40	36.0	17.5	100	89.9	43.8	160	143.8	70.1	220	197.7	96.4	280	251.7	122.7
41	36.9	18.0	101	90.8	44.3	161	144.7	71.6	221	198.6	96.9	281	252.6	123.2
42	37.7	18.4	102	91.7	44.7	162	145.6	71.0	222	199.5	97.3	282	253.5	123.6
43	38.6	18.8	103	92.6	45.2	163	146.5	71.5	223	200.4	97.8	283	254.4	124.1
44	39.5	19.3	104	93.5	45.6	164	147.4	71.9	224	201.3	98.2	284	255.3	124.5
45	40.4	19.7	105	94.4	46.0	165	148.3	72.3	225	202.2	98.6	285	256.2	124.9
46	41.3	20.2	106	95.3	46.5	166	149.2	72.8	226	203.1	99.1	286	257.1	125.4
47	42.2	20.6	107	96.2	46.9	167	150.1	73.2	227	204.0	99.5	287	258.0	125.8
48	43.1	21.0	108	97.1	47.3	168	151.0	73.6	228	204.9	99.9	288	258.9	126.3
49	44.0	21.5	109	98.0	47.8	169	151.9	74.1	229	205.8	100.4	289	259.8	126.7
50	44.9	21.9	110	98.9	48.2	170	152.8	74.5	230	206.7	100.8	290	260.7	127.1
51	45.8	22.4	111	99.8	48.7	171	153.7	75.0	231	207.6	101.3	291	261.5	127.6
52	46.7	22.8	112	100.7	49.1	172	154.6	75.4	232	208.5	101.7	292	262.4	128.0
53	47.6	23.2	113	101.6	49.5	173	155.5	75.8	233	209.4	102.1	293	263.3	128.4
54	48.5	23.7	114	102.5	50.0	174	156.4	76.3	234	210.3	102.6	294	264.2	128.9
55	49.4	24.1	115	103.4	50.4	175	157.3	76.7	235	211.2	103.0	295	265.1	129.3
56	50.3	24.5	116	104.3	50.9	176	158.2	77.2	236	212.1	103.5	296	266.0	129.8
57	51.2	25.0	117	105.2	51.3	177	159.1	77.6	237	213.0	103.9	297	266.9	130.2
58	52.1	25.4	118	106.1	51.7	178	160.0	78.0	238	213.9	104.3	298	267.8	130.6
59	53.0	25.9	119	107.0	52.2	179	160.9	78.5	239	214.8	104.8	299	268.7	131.1
60	53.9	26.3	120	107.9	52.6	180	161.8	78.9	240	215.7	105.2	300	269.6	131.5
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 64 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 27 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.5	61	54.4	27.7	121	107.8	54.9	181	161.3	82.2	241	214.7	109.4
2	01 8	00.9	62	55.2	28.1	122	108.7	55.4	182	162.2	82.6	242	215.6	109.9
3	02.7	01.4	63	56 1	28.6	123	109 6	55.8	183	163.1	83.1	243	216.5	110.3
4	03.6	01.8	64	57.0	29.1	124	110.5	56 3	184	163.9	83.5	244	217 4	110.8
5	04.5	02.3	65	57.9	29.5	125	111.4	56.7	185	164.8	84.0	245	218.3	111.2
6	05.3	02.7	66	58.8	30.0	126	112.3	57.2	186	165.7	84.4	246	219.2	111.7
7	06.2	03.2	67	59.7	30.4	127	113.2	57.7	187	166.6	84.9	247	220.1	112.1
8	07.1	03.6	68	60.6	30.9	128	114.0	58.1	188	167.5	85.4	248	221.0	112.6
9	08 0	04.1	69	61.5	31.3	129	114.9	58.6	189	168.4	85.8	249	221.9	113.0
10	08.9	04.5	70	62.4	31.8	130	115.8	59.0	190	169.3	86.3	250	222.8	113.5
11	09.8	05.0	71	63.3	32.2	131	116.7	59.5	191	170.2	86.7	251	223.6	114.0
12	10.7	05.4	72	64.2	32.7	132	117.6	59.9	192	171.1	87.2	252	224.5	114.4
13	11 6	05.9	73	65.0	33.1	133	118.5	60.4	193	172.0	87.6	253	225.4	114.9
14	12.5	06.4	74	65.9	33.6	134	119.4	60.8	194	172.9	88 1	254	226.3	115.3
15	13.4	06.8	75	66.8	34.0	135	120.3	61.3	195	173.7	88.5	255	227.2	115.8
16	14.3	07.3	76	67.7	34.5	136	121.2	61.7	196	174.6	89.0	256	228.1	116.2
17	15.1	07.7	77	68.6	35.0	137	122.1	62.2	197	175.5	89.4	257	229.0	116.7
18	16.0	08.2	78	69.5	35.4	138	123.0	62.7	198	176.4	89.9	258	229.9	117.1
19	16.9	08.6	79	70 4	35.9	139	123.8	63.1	199	177.3	90.3	259	230.8	117.6
20	17.8	09.1	80	71 3	36.3	140	124.7	63.6	200	178.2	90.8	260	231.7	118.0
21	18.7	09.5	81	72.2	36.8	141	125.6	64.0	201	179.1	91.3	261	232.6	118.5
22	19.6	10.0	82	73.1	37.2	142	126.5	64.5	202	180.0	91.7	262	233.4	118.9
23	20.5	10.4	83	74.0	37.7	143	127.4	64.9	203	180.9	92.2	263	234.3	119.4
24	21.4	10.9	84	74.8	38.1	144	128.3	65.4	204	181.8	92.6	264	235.2	119.9
25	22.3	11.3	85	75.7	38.6	145	129.2	65.8	205	182.7	93.1	265	236.1	120.3
26	23.2	11.8	86	76.6	39.0	146	130 1	66.3	206	183.5	93.5	266	237.0	120.8
27	24.1	12.3	87	77.5	39.5	147	131.0	66.7	207	184.4	94.0	267	237.9	121.2
28	24.9	12.7	88	78.4	40.0	148	131.9	67.2	208	185.3	94.4	268	238.8	121.7
29	25.8	13.2	89	79.3	40.4	149	132.8	67.6	209	186.2	94.9	269	239.7	122.1
30	26.7	13.6	90	80.2	40.9	150	133.7	68.1	210	187.1	95.3	270	240.6	122.6
31	27.6	14.1	91	81.1	41.3	151	134.5	68.6	211	188.0	95.8	271	241.5	123.0
32	28.5	14.5	92	82.0	41.8	152	135.4	69.0	212	188.9	96.2	272	242.4	123.5
33	29.4	15.0	93	82.9	42.2	153	136.3	69.5	213	189.8	96.7	273	243.2	123.9
34	30.3	15.4	94	83.8	42.7	154	137.2	69.9	214	190 7	97.2	274	244.1	124.4
35	31.2	15.9	95	84.6	43.1	155	138.1	70.4	215	191.6	97.6	275	245.0	124.8
36	32.1	16.3	96	85.5	43.6	156	139.0	70.8	216	192.5	98.1	276	245.9	125.3
37	33.0	16.8	97	86.4	44.0	157	139.9	71.3	217	193.3	98.5	277	246.8	125.8
38	33.9	17.3	98	87.3	44.5	158	140.8	71.7	218	194.2	99.0	278	247.7	126.2
39	34.7	17.7	99	88.2	44.9	159	141.7	72.2	219	195.1	99.4	279	248.6	126.7
40	35.6	18.2	100	89.1	45.4	160	142.6	72.6	220	196.0	99.9	280	249.5	127.1
41	36.5	18.6	101	90.0	45.9	161	143.5	73 1	221	196 9	100.3	281	250.4	127.6
42	37.4	19.1	102	90.9	46.3	162	144.3	73.5	222	197.8	100.8	282	251.3	128.0
43	38.3	19.5	103	91.8	46 8	163	145.2	74.0	223	198.7	101.2	283	252.2	128.5
44	39.2	20.0	104	92 7	47.2	164	146 1	74.5	224	199.6	101.7	284	253.0	128.9
45	40.1	20.4	105	93.6	47.7	165	147.0	74.9	225	200.5	102.1	285	253.9	129.4
46	41.0	20.9	106	94.4	48 1	166	147 9	75.4	226	201.4	102.6	286	254.8	129.8
47	41.9	21.3	107	95.3	48.6	167	148.8	75.8	227	202.3	103.1	287	255.7	130.3
48	42.8	21.8	108	96.2	49.0	168	149.7	76.3	228	203.1	103.5	288	256.6	130.7
49	43.7	22.2	109	97.1	49.5	169	150.6	76.7	229	204.0	104.0	289	257.5	131.2
50	44.6	22.7	110	98.0	49.9	170	151.5	77 2	230	204.9	104.4	290	258.4	131.7
51	45.4	23.2	111	98.9	50.4	171	152.4	77.6	231	205.8	104.9	291	259.3	132.1
52	46.3	23.6	112	99.8	50.8	172	153.3	78.1	232	206.7	105.3	292	260.2	132.6
53	47.2	24.1	113	100.7	51.3	173	154.1	78.5	233	207.6	105.8	293	261.1	133.0
54	48.1	24.5	114	101.6	51.8	174	155.0	79.0	234	208.5	106.2	294	262.0	133.5
55	49.0	25.0	115	102.5	52.2	175	155.9	79.4	235	209.4	106.7	295	262.8	133.9
56	49.9	25.4	116	103.4	52.7	176	156.8	79.9	236	210.3	107.1	296	263.7	134.4
57	50.8	25.9	117	104.2	53.1	177	157.7	80.4	237	211.2	107.6	297	264.6	134.8
58	51.7	26.3	118	105.1	53.6	178	158.6	80.8	238	212.1	108.0	298	265.5	135.3
59	52.6	26.8	119	106.0	54.0	179	159.5	81.3	239	213.0	108.5	299	266.4	135.7
60	53.5	27.2	120	106.9	54.5	180	160.4	81.7	240	213.8	109.0	300	267.3	136.2
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 63 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 28 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.5	61	53.9	28.6	121	106.8	56.8	181	159.8	85.0	241	212.8	113.1
2	01.8	00.9	62	54.7	29.1	122	107.7	57.3	182	160.7	85.4	242	213.7	113.6
3	02.6	01.4	63	55.6	29.6	123	108.6	57.7	183	161.6	85.9	243	214.6	114.1
4	03.5	01.9	64	56.5	30.0	124	109.5	58.2	184	162.5	86.4	244	215.4	114.6
5	04.4	02.3	65	57.4	30.5	125	110.4	58.7	185	163.3	86.9	245	216.3	115.0
6	05.3	02.8	66	58.3	31.0	126	111.3	59.2	186	164.2	87.3	246	217.2	115.5
7	06.2	03.3	67	59.2	31.5	127	112.1	59.6	187	165.1	87.8	247	218.1	116.0
8	07.1	03.8	68	60.0	31.9	128	113.0	60.1	188	166.0	88.3	248	219.0	116.4
9	07.9	04.2	69	60.9	32.4	129	113.9	60.6	189	166.9	88.7	249	219.9	116.9
10	08.8	04.7	70	61.8	32.9	130	114.8	61.0	190	167.8	89.2	250	220.7	117.4
11	09.7	05.2	71	62.7	33.3	131	115.7	61.5	191	168.6	89.7	251	221.6	117.9
12	10.6	05.6	72	63.6	33.8	132	116.5	62.0	192	169.5	90.1	252	222.5	118.3
13	11.5	06.1	73	64.5	34.3	133	117.4	62.4	193	170.4	90.6	253	223.4	118.8
14	12.4	06.6	74	65.3	34.7	134	118.3	62.9	194	171.3	91.1	254	224.3	119.2
15	13.2	07.0	75	66.2	35.2	135	119.2	63.4	195	172.2	91.5	255	225.2	119.7
16	14.1	07.5	76	67.1	35.7	136	120.1	63.8	196	173.1	92.0	256	226.0	120.2
17	15.0	08.0	77	68.0	36.1	137	121.0	64.3	197	173.9	92.5	257	226.9	120.7
18	15.9	08.5	78	68.9	36.6	138	121.8	64.8	198	174.8	93.0	258	227.8	121.1
19	16.8	08.9	79	69.8	37.1	139	122.7	65.3	199	175.7	93.4	259	228.7	121.6
20	17.7	09.4	80	70.6	37.6	140	123.6	65.7	200	176.6	93.9	260	229.6	122.1
21	18.5	09.9	81	71.5	38.0	141	124.5	66.2	201	177.5	94.4	261	230.4	122.5
22	19.4	10.3	82	72.4	38.5	142	125.4	66.7	202	178.4	94.8	262	231.3	123.0
23	20.3	10.8	83	73.3	39.0	143	126.3	67.1	203	179.2	95.3	263	232.2	123.5
24	21.2	11.3	84	74.2	39.4	144	127.1	67.6	204	180.1	95.8	264	233.1	123.9
25	22.1	11.7	85	75.1	39.9	145	128.0	68.1	205	181.0	96.2	265	234.0	124.4
26	23.0	12.2	86	75.9	40.4	146	128.9	68.5	206	181.9	96.7	266	234.9	124.9
27	23.8	12.7	87	76.8	40.8	147	129.8	69.0	207	182.8	97.2	267	235.7	125.3
28	24.7	13.1	88	77.7	41.3	148	130.7	69.5	208	183.7	97.7	268	236.6	125.8
29	25.6	13.6	89	78.6	41.8	149	131.6	70.0	209	184.5	98.1	269	237.5	126.3
30	26.5	14.1	90	79.5	42.3	150	132.4	70.4	210	185.4	98.6	270	238.4	126.8
31	27.4	14.6	91	80.3	42.7	151	133.3	70.9	211	186.3	99.1	271	239.3	127.2
32	28.3	15.0	92	81.2	43.2	152	134.2	71.4	212	187.2	99.5	272	240.2	127.7
33	29.1	15.5	93	82.1	43.7	153	135.1	71.8	213	188.1	100.0	273	241.0	128.2
34	30.0	16.0	94	83.0	44.1	154	136.0	72.3	214	189.0	100.5	274	241.9	128.6
35	30.9	16.4	95	83.9	44.6	155	136.9	72.8	215	189.8	100.9	275	242.8	129.1
36	31.8	16.9	96	84.8	45.1	156	137.7	73.2	216	190.7	101.4	276	243.7	129.6
37	32.7	17.4	97	85.6	45.5	157	138.6	73.7	217	191.6	101.9	277	244.6	130.0
38	33.6	17.8	98	86.5	46.0	158	139.5	74.2	218	192.5	102.3	278	245.5	130.5
39	34.4	18.3	99	87.4	46.5	159	140.4	74.6	219	193.4	102.8	279	246.3	131.0
40	35.3	18.8	100	88.3	46.9	160	141.3	75.1	220	194.2	103.3	280	247.2	131.5
41	36.2	19.2	101	89.2	47.4	161	142.2	75.6	221	195.1	103.8	281	248.1	131.9
42	37.1	19.7	102	90.1	47.9	162	143.0	76.1	222	196.0	104.2	282	249.0	132.4
43	38.0	20.2	103	90.9	48.4	163	143.9	76.5	223	196.9	104.7	283	249.9	132.9
44	38.8	20.7	104	91.8	48.8	164	144.8	77.0	224	197.8	105.2	284	250.8	133.3
45	39.7	21.1	105	92.7	49.3	165	145.7	77.5	225	198.7	105.6	285	251.6	133.8
46	40.6	21.6	106	93.6	49.8	166	146.6	77.9	226	199.5	106.1	286	252.5	134.3
47	41.5	22.1	107	94.5	50.2	167	147.5	78.4	227	200.4	106.6	287	253.4	134.7
48	42.4	22.5	108	95.4	50.7	168	148.3	78.9	228	201.3	107.0	288	254.3	135.2
49	43.3	23.0	109	96.2	51.2	169	149.2	79.3	229	202.2	107.5	289	255.2	135.7
50	44.1	23.5	110	97.1	51.6	170	150.1	79.8	230	203.1	108.0	290	256.1	136.1
51	45.0	23.9	111	98.0	52.1	171	151.0	80.3	231	204.0	108.4	291	256.9	136.6
52	45.9	24.4	112	98.9	52.6	172	151.9	80.7	232	204.8	108.9	292	257.8	137.1
53	46.8	24.9	113	99.8	53.1	173	152.7	81.2	233	205.7	109.4	293	258.7	137.6
54	47.7	25.4	114	100.7	53.5	174	153.6	81.7	234	206.6	109.9	294	259.6	138.0
55	48.6	25.8	115	101.5	54.0	175	154.5	82.2	235	207.5	110.3	295	260.5	138.5
56	49.4	26.3	116	102.4	54.5	176	155.4	82.6	236	208.4	110.8	296	261.3	139.0
57	50.3	26.8	117	103.3	54.9	177	156.3	83.1	237	209.3	111.3	297	262.2	139.4
58	51.2	27.2	118	104.2	55.4	178	157.2	83.6	238	210.1	111.7	298	263.1	139.9
59	52.1	27.7	119	105.1	55.9	179	158.0	84.0	239	211.0	112.2	299	264.0	140.4
60	53.0	28.2	120	106.0	56.3	180	158.9	84.5	240	211.9	112.7	300	264.9	140.8
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 62 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 29 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.5	61	53.4	29.6	121	105.8	58.7	181	158.3	87.8	241	210.8	116.8
2	01.7	01.0	62	54.2	30.1	122	106.7	59.1	182	159.2	88.2	242	211.7	117.3
3	02.6	01.5	63	55.1	30.5	123	107.6	59.6	183	160.1	88.7	243	212.5	117.8
4	03.5	01.9	64	56.0	31.0	124	108.5	60.1	184	160.9	89.2	244	213.4	118.3
5	04.4	02.4	65	56.9	31.5	125	109.3	60.6	185	161.8	89.7	245	214.3	118 8
6	05.2	02.9	66	57.7	32.0	126	110.2	61.1	186	162.7	90.2	246	215.2	119.3
7	06.1	03.4	67	58.6	32.5	127	111.1	61.6	187	163.6	90.7	247	216.0	119.7
8	07.0	03.9	68	59.5	33.0	128	112.0	62.1	188	164.4	91.1	248	216.9	120.2
9	07.9	04.4	69	60.3	33.5	129	112.8	62.5	189	165.3	91.6	249	217.8	120.7
10	08.7	04.8	70	61.2	33.9	130	113.7	63.0	190	166.2	92.1	250	218.7	121.2
11	09.6	05.3	71	62.1	34.4	131	114 6	63.5	191	167.1	92.6	251	219.5	121.7
12	10.5	05.8	72	63.0	34.9	132	115.4	64.0	192	167.9	93.1	252	220.4	122.2
13	11.4	06.3	73	63.8	35.4	133	116.3	64.5	193	168.8	93.6	253	221.3	122.7
14	12.2	06.8	74	64.7	35.9	134	117.2	65.0	194	169.7	94.1	254	222.2	123.1
15	13.1	07.3	75	65.6	36.4	135	118.1	65.4	195	170.6	94.5	255	223 0	123.6
16	14 0	07.8	76	66.5	36.8	136	118.9	65.9	196	171.4	95.0	256	223.9	124.1
17	14.9	08.2	77	67.3	37.3	137	119.8	66.4	197	172.3	95.5	257	224.8	124.6
18	15.7	08.7	78	68.2	37.8	138	120.7	66.9	198	173.2	96.0	258	225.7	125.1
19	16.6	09.2	79	69.1	38.3	139	121.6	67.4	199	174.0	96.5	259	226.5	125.6
20	17.5	09.7	80	70.0	38.8	140	122.4	67.9	200	174.9	97.0	260	227.4	126.1
21	18.4	10.2	81	70.8	39.3	141	123.3	68.4	201	175.8	97.4	261	228.3	126.5
22	19 2	10.7	82	71.7	39.8	142	124.2	68.8	202	176.7	97.9	262	229.2	127.0
23	20.1	11.2	83	72.6	40.2	143	125.1	69.3	203	177.5	98.4	263	230.0	127.5
24	21.0	11.6	84	73.5	40.7	144	125.9	69.8	204	178.4	98.9	264	230.9	128.0
25	21.9	12.1	85	74.3	41.2	145	126.8	70.3	205	179.3	99.4	265	231.8	128.5
26	22.7	12.6	86	75.2	41.7	146	127.7	70.8	206	180.2	99.9	266	232.6	129.0
27	23.6	13.1	87	76.1	42.2	147	128.6	71.3	207	181.0	100.4	267	233.5	129.4
28	24.5	13.6	88	77.0	42.7	148	129.4	71.8	208	181.9	100.8	268	234.4	129 9
29	25.4	14.1	89	77.8	43.1	149	130.3	72.2	209	182.8	101.3	269	235.3	130.4
30	26.2	14.5	90	78.7	43.6	150	131.2	72.7	210	183.7	101.8	270	236.1	130.9
31	27.1	15.0	91	79.6	44.1	151	132.1	73.2	211	184.5	102.3	271	237.0	131.4
32	28.0	15.5	92	80.5	44.6	152	132.9	73.7	212	185.4	102.8	272	237.9	131.9
33	28.9	16.0	93	81.3	45.1	153	133.8	74.2	213	186.3	103.3	273	238.8	132.4
34	29.7	16.5	94	82.2	45.6	154	134.7	74.7	214	187.2	103.7	274	239.6	132.8
35	30.6	17.0	95	83.1	46.1	155	135.6	75.1	215	188.0	104.2	275	240.5	133.3
36	31.5	17.5	96	84.0	46.5	156	136.4	75.6	216	188.9	104.7	276	241.4	133.8
37	32.4	17.9	97	84.8	47.0	157	137.3	76 1	217	189.8	105.2	277	242.3	134.3
38	33.2	18.4	98	85.7	47.5	158	138.2	76.6	218	190.7	105.7	278	243.1	134.8
39	34.1	18.9	99	86.6	48.0	159	139.1	77.1	219	191.5	106.2	279	244.0	135.3
40	35.0	19.4	100	87.5	48.5	160	139.9	77.6	220	192.4	106.7	280	244.9	135.7
41	35.9	19.9	101	88.3	49.0	161	140.8	78.1	221	193.3	107.1	281	245.8	136.2
42	36.7	20.4	102	89.2	49.5	162	141.7	78.5	222	194.2	107.6	282	246.6	136.7
43	37.6	20 8	103	90.1	49.9	163	142.6	79.0	223	195.0	108.1	283	247.5	137.2
44	38.5	21.3	104	91.0	50.4	164	143.4	79.5	224	195.9	108.5	284	248.4	137.7
45	39.4	21.8	105	91.8	50.9	165	144.3	80.0	225	196.8	109.1	285	249.3	138.2
46	40.2	22.3	106	92.7	51.4	166	145.2	80 5	226	197.7	109.6	286	250.1	138.7
47	41.1	22.8	107	93.6	51.9	167	146 1	81.0	227	198.5	110.1	287	251.0	139.1
48	42.0	23.3	108	94.5	52.4	168	146.9	81.4	228	199.4	110.5	288	251.9	139.6
49	42.9	23.8	109	95.3	52.8	169	147.8	81.9	229	200.3	111.0	289	252.8	140.1
50	43.7	24.2	110	96.2	53.3	170	148.7	82.4	230	201.2	111.5	290	253.6	140.6
51	44.6	24 7	111	97.1	53.8	171	149.6	82.9	231	202.0	112.0	291	254.5	141.1
52	45.5	25.2	112	98.0	54.3	172	150.4	83.4	232	202.9	112.5	292	255 4	141.6
53	46.4	25.7	113	98.8	54.8	173	151.3	83.9	233	203.8	113.0	293	256.3	142.0
54	47.2	26.2	114	99.7	55.3	174	152.2	84.4	234	204.7	113.4	294	257.1	142.5
55	48.1	26.7	115	100.6	55.8	175	153.1	84.8	235	205.5	113.9	295	258 0	143.0
56	49.0	27.1	116	101.5	56.2	176	153.9	85.3	236	206.4	114.4	296	258.9	143 5
57	49.9	27.6	117	102.3	56.7	177	154.8	85.8	237	207.3	114.9	297	259.8	144 0
58	50.7	28.1	118	103 2	57.2	178	155.7	86.3	238	208.2	115.4	298	260 6	144.5
59	51.6	28.6	119	104 1	57 7	179	156.6	86.8	239	209.0	115.9	299	261.5	145 0
60	52.5	29 1	120	105.0	58.2	180	157.4	87.3	240	209.9	116.4	300	262.4	145.4
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 61 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 30 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.5	61	52.8	30.5	121	104.8	60.5	181	156.8	90.5	241	208.7	120.5
2	01.7	01.0	62	53.7	31.0	122	105.7	61.0	182	157.6	91.0	242	209.6	121.0
3	02.6	01.5	63	54.6	31.5	123	106.5	61.5	183	158.5	91.5	243	210.4	121.5
4	03.5	02.0	64	55.4	32.0	124	107.4	62.0	184	159.3	92.0	244	211.3	122.0
5	04.3	02.5	65	56.3	32.5	125	108.3	62.5	185	160.2	92.5	245	212.2	122.5
6	05.2	03.0	66	57.2	33.0	126	109.1	63.0	186	161.1	93.0	246	213.0	123.0
7	06.1	03.5	67	58.0	33.5	127	110.0	63.5	187	161.9	93.5	247	213.9	123.5
8	06.9	04.0	68	58.9	34.0	128	110.9	64.0	188	162.8	94.0	248	214.8	124.0
9	07.8	04.5	69	59.8	34.5	129	111.7	64.5	189	163.7	94.5	249	215.6	124.5
10	08.7	05.0	70	60.6	35.0	130	112.6	65.0	190	164.5	95.0	250	216.5	125.0
11	09.5	05.5	71	61.5	35.5	131	113.4	65.5	191	165.4	95.5	251	217.4	125.5
12	10.4	06.0	72	62.4	36.0	132	114.3	66 0	192	166.3	96.0	252	218.2	126.0
13	11.3	06.5	73	63.2	36.5	133	115.2	66.5	193	167.1	96.5	253	219.1	126.5
14	12.1	07.0	74	64.1	37.0	134	116.0	67.0	194	168.0	97.0	254	220.0	127.0
15	13.0	07.5	75	65.0	37.5	135	116.9	67.5	195	168.9	97.5	255	220.8	127.5
16	13.9	08.0	76	65.8	38.0	136	117.8	68.0	196	169.7	98.0	256	221.7	128.0
17	14.7	08.5	77	66.7	38.5	137	118.6	68.5	197	170.6	98.5	257	222.6	128.5
18	15.6	09.0	78	67.5	39.0	138	119.5	69.0	198	171.5	99.0	258	223.4	129.0
19	16.5	09.5	79	68.4	39.5	139	120.4	69.5	199	172.3	99.5	259	224.3	129.5
20	17.3	10.0	80	69.3	40.0	140	121.2	70.0	200	173.2	100.0	260	225.2	130.0
21	18.2	10.5	81	70.1	40.5	141	122.1	70.5	201	174.1	100.5	261	226.0	130.5
22	19.1	11.0	82	71.0	41.0	142	123.0	71.0	202	174.9	101.0	262	226.9	131.0
23	19.9	11.5	83	71.9	41.5	143	123.8	71.5	203	175.8	101.5	263	227.8	131.5
24	20.8	12.0	84	72.7	42.0	144	124.7	72.0	204	176.7	102.0	264	228.6	132.0
25	21.7	12.5	85	73.6	42.5	145	125.6	72.5	205	177.5	102.5	265	229.5	132.5
26	22.5	13.0	86	74.5	43.0	146	126.4	73.0	206	178.4	103.0	266	230.4	133.0
27	23.4	13.5	87	75.3	43.5	147	127.3	73.5	207	179.3	103.5	267	231.2	133.5
28	24.2	14.0	88	76.2	44.0	148	128.2	74.0	208	180.1	104.0	268	232.1	134.0
29	25.1	14.5	89	77.1	44.5	149	129.0	74.5	209	181.0	104.5	269	233.0	134.5
30	26.0	15.0	90	77.9	45.0	150	129.9	75.0	210	181.9	105.0	270	233.8	135.0
31	26.8	15.5	91	78.8	45.5	151	130.8	75.5	211	182.7	105.5	271	234.7	135.5
32	27.7	16.0	92	79.7	46.0	152	131.6	76.0	212	183.6	106.0	272	235.6	136.0
33	28.6	16.5	93	80.5	46.5	153	132.5	76.5	213	184.5	106.5	273	236.4	136.5
34	29.4	17.0	94	81.4	47.0	154	133.4	77.0	214	185.3	107.0	274	237.3	137.0
35	30.3	17.5	95	82.3	47.5	155	134.2	77.5	215	186.2	107.5	275	238.2	137.5
36	31.2	18.0	96	83.1	48.0	156	135.1	78.0	216	187.1	108.0	276	239.0	138.0
37	32.0	18.5	97	84.0	48.5	157	136.0	78.5	217	187.9	108.5	277	239.9	138.5
38	32.9	19.0	98	84.9	49.0	158	136.8	79.0	218	188.8	109.0	278	240.8	139.0
39	33.8	19.5	99	85.7	49.5	159	137.7	79.5	219	189.7	109.5	279	241.6	139.5
40	34.6	20.0	100	86.6	50.0	160	138.6	80.0	220	190.5	110.0	280	242.5	140.0
41	35.5	20.5	101	87.5	50.5	161	139.4	80.5	221	191.4	110.5	281	243.4	140.5
42	36.4	21.0	102	88.3	51.0	162	140.3	81.0	222	192.3	111.0	282	244.2	141.0
43	37.2	21.5	103	89.2	51.5	163	141.2	81.5	223	193.1	111.5	283	245.1	141.5
44	38.1	22.0	104	90.1	52.0	164	142.0	82.0	224	194.0	112.0	284	246.0	142.0
45	39.0	22.5	105	90.9	52.5	165	142.9	82.5	225	194.9	112.5	285	246.8	142.5
46	39.8	23.0	106	91.8	53.0	166	143.8	83.0	226	195.7	113.0	286	247.7	143.0
47	40.7	23.5	107	92.7	53.5	167	144.6	83.5	227	196.6	113.5	287	248.5	143 5
48	41.6	24.0	108	93.5	54 0	168	145 5	84.0	228	197.5	114 0	288	249.4	144.0
49	42.4	24.5	109	94.4	54.5	169	146.4	84.5	229	198 3	114.5	289	250.3	144.5
50	43.3	25 0	110	95.3	55.0	170	147.2	85.0	230	199.2	115.0	290	251.1	145.0
51	44.2	25.5	111	96.1	55.5	171	148.1	85.5	231	200.1	115.5	291	252.0	145.5
52	45.0	26.0	112	97.0	56.0	172	149.0	86.0	232	200.9	116.0	292	252.9	146.0
53	45.9	26.5	113	97.9	56.5	173	149.8	86.5	233	201.8	116.5	293	253.7	146.5
54	46.8	27.0	114	98.7	57.0	174	150.7	87.0	234	202.6	117.0	294	254.6	147.0
55	47.6	27.5	115	99.6	57.5	175	151.6	87.5	235	203.5	117.5	295	255.5	147.5
56	48.5	28.0	116	100.5	58.0	176	152.4	88.0	236	204.4	118.0	296	256.3	148.0
57	49.4	28.5	117	101.3	58.5	177	153.3	88.5	237	205.2	118.5	297	257.2	148.5
58	50.2	29.0	118	102.2	59 0	178	154.2	89.0	238	206.1	119.0	298	258.1	149.0
59	51.1	29.5	119	103.1	59.5	179	155.0	89.5	239	207.0	119.5	299	258.9	149.5
60	52.0	30.0	120	103.9	60.0	180	155.9	90.0	240	207.8	120.0	300	259.8	150.0
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 60 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 31 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.9	00.5	61	52.3	31.4	121	103.7	62.3	181	155.1	93.2	241	206.6	124.1
2	01.7	01.0	62	53.1	31.9	122	104.6	62.8	182	156.0	93.7	242	207.4	124.6
3	02.6	01.5	63	54.0	32.4	123	105.4	63.3	183	156.9	94.3	243	208.3	125.2
4	03.4	02.1	64	54.9	33.0	124	106.3	63.9	184	157.7	94.8	244	209.1	125.7
5	04.3	02.6	65	55.7	33.5	125	107.1	64.4	185	158.6	95.3	245	210.0	126.2
6	05.1	03.1	66	56.6	34.0	126	108.0	64.9	186	159.4	95.8	246	210.9	126.7
7	06.0	03.6	67	57.4	34.5	127	108.9	65.4	187	160.3	96.3	247	211.7	127.2
8	06.9	04.1	68	58.3	35.0	128	109.7	65.9	188	161.1	96.8	248	212.6	127.7
9	07.7	04.6	69	59.1	35.5	129	110.6	66.4	189	162.0	97.3	249	213.4	128.2
10	08.6	05.2	70	60.0	36.1	130	111.4	67.0	190	162.9	97.9	250	214.3	128.8
11	09.4	05.7	71	60.9	36.6	131	112.3	67.5	191	163.7	98.4	251	215.1	129.3
12	10.3	06.2	72	61.7	37.1	132	113.1	68.0	192	164.6	98.9	252	216.0	129.8
13	11.1	06.7	73	62.6	37.6	133	114.0	68.5	193	165.4	99.4	253	216.9	130.3
14	12.0	07.2	74	63.4	38.1	134	114.9	69.0	194	166.3	99.9	254	217.7	130.8
15	12.9	07.7	75	64.3	38.6	135	115.7	69.5	195	167.1	100.4	255	218.6	131.3
16	13.7	08.2	76	65.1	39.1	136	116.6	70.0	196	168.0	100.9	256	219.4	131.8
17	14.6	08.8	77	66.0	39.7	137	117.4	70.6	197	168.9	101.5	257	220.3	132.4
18	15.4	09.3	78	66.9	40.2	138	118.3	71.1	198	169.7	102.0	258	221.1	132.9
19	16.3	09.8	79	67.7	40.7	139	119.1	71.6	199	170.6	102.5	259	222.0	133.4
20	17.1	10.3	80	68.6	41.2	140	120.0	72.1	200	171.4	103.0	260	222.9	133.9
21	18.0	10.8	81	69.4	41.7	141	120.9	72.6	201	172.3	103.5	261	223.7	134.4
22	18.9	11.3	82	70.3	42.2	142	121.7	73.1	202	173.1	104.0	262	224.6	134.9
23	19.7	11.8	83	71.1	42.7	143	122.6	73.7	203	174.0	104.6	263	225.4	135.5
24	20.6	12.4	84	72.0	43.3	144	123.4	74.2	204	174.9	105.1	264	226.3	136.0
25	21.4	12.9	85	72.9	43.8	145	124.3	74.7	205	175.7	105.6	265	227.1	136.5
26	22.3	13.4	86	73.7	44.3	146	125.1	75.2	206	176.6	106.1	266	228.0	137.0
27	23.1	13.9	87	74.6	44.8	147	126.0	75.7	207	177.4	106.6	267	228.9	137.5
28	24.0	14.4	88	75.4	45.3	148	126.9	76.2	208	178.3	107.1	268	229.7	138.0
29	24.9	14.9	89	76.3	45.8	149	127.7	76.7	209	179.1	107.6	269	230.6	138.5
30	25.7	15.5	90	77.1	46.4	150	128.6	77.3	210	180.0	108.2	270	231.4	139.1
31	26.6	16.0	91	78.0	46.9	151	129.4	77.8	211	180.9	108.7	271	232.3	139.6
32	27.4	16.5	92	78.9	47.4	152	130.3	78.3	212	181.7	109.2	272	233.1	140.1
33	28.3	17.0	93	79.7	47.9	153	131.1	78.8	213	182.6	109.7	273	234.0	140.6
34	29.1	17.5	94	80.6	48.4	154	132.0	79.3	214	183.4	110.2	274	234.9	141.1
35	30.0	18.0	95	81.4	48.9	155	132.9	79.8	215	184.3	110.7	275	235.7	141.6
36	30.9	18.5	96	82.3	49.4	156	133.7	80.3	216	185.1	111.2	276	236.6	142.2
37	31.7	19.1	97	83.1	50.0	157	134.6	80.9	217	186.0	111.8	277	237.4	142.7
38	32.6	19.6	98	84.0	50.5	158	135.4	81.4	218	186.9	112.3	278	238.3	143.2
39	33.4	20.1	99	84.9	51.0	159	136.3	81.9	219	187.7	112.8	279	239.1	143.7
40	34.3	20.6	100	85.7	51.5	160	137.1	82.4	220	188.6	113.3	280	240.0	144.2
41	35.1	21.1	101	86.6	52.0	161	138.0	82.9	221	189.4	113.8	281	240.9	144.7
42	36.0	21.6	102	87.4	52.5	162	138.9	83.4	222	190.3	114.3	282	241.7	145.2
43	36.9	22.1	103	88.3	53.0	163	139.7	84.0	223	191.1	114.9	283	242.6	145.8
44	37.7	22.7	104	89.1	53.6	164	140.6	84.5	224	192.0	115.4	284	243.4	146.3
45	38.6	23.2	105	90.0	54.1	165	141.4	85.0	225	192.9	115.9	285	244.3	146.8
46	39.4	23.7	106	90.9	54.6	166	142.3	85.5	226	193.7	116.4	286	245.1	147.3
47	40.3	24.2	107	91.7	55.1	167	143.1	86.0	227	194.6	116.9	287	246.0	147.8
48	41.1	24.7	108	92.6	55.6	168	144.0	86.5	228	195.4	117.4	288	246.9	148.3
49	42.0	25.2	109	93.4	56.1	169	144.9	87.0	229	196.3	117.9	289	247.7	148.8
50	42.9	25.8	110	94.3	56.7	170	145.7	87.6	230	197.1	118.5	290	248.6	149.4
51	43.7	26.3	111	95.1	57.2	171	146.6	88.1	231	198.0	119.0	291	249.4	149.9
52	44.6	26.8	112	96.0	57.7	172	147.4	88.6	232	198.9	119.5	292	250.3	150.4
53	45.4	27.3	113	96.9	58.2	173	148.3	89.1	233	199.7	120.0	293	251.2	150.9
54	46.3	27.8	114	97.7	58.7	174	149.1	89.6	234	200.6	120.5	294	252.0	151.4
55	47.1	28.3	115	98.6	59.2	175	150.0	90.1	235	201.4	121.0	295	252.9	151.9
56	48.0	28.8	116	99.4	59.7	176	150.9	90.6	236	202.3	121.5	296	253.7	152.5
57	48.9	29.4	117	100.3	60.3	177	151.7	91.2	237	203.1	122.1	297	254.6	153.0
58	49.7	29.9	118	101.1	60.8	178	152.6	91.7	238	204.0	122.6	298	255.4	153.5
59	50.6	30.4	119	102.0	61.3	179	153.4	92.2	239	204.9	123.1	299	256.3	154.0
60	51.4	30.9	120	102.9	61.8	180	154.3	92.7	240	205.7	123.6	300	257.1	154.5
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 59 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 32 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.5	61	51.7	32.3	121	102 6	64.1	181	153.5	95.9	241	204.4	127.7
2	01.7	01.1	62	52.6	32.9	122	103.5	64.7	182	154.3	96.4	242	205.2	128.2
3	02.5	01.6	63	53.4	33.4	123	104.3	65.2	183	155.2	97.0	243	206.1	128.8
4	03.4	02.1	64	54.3	33.9	124	105.2	65.7	184	156.0	97.5	244	206.9	129.3
5	04.2	02.6	65	55.1	34.4	125	106.0	66.2	185	156.9	98.0	245	207.8	129.8
6	05.1	03.2	66	56.0	35.0	126	106.9	66.8	186	157.7	98.6	246	208.6	130.4
7	05.9	03.7	67	56.8	35.5	127	107.7	67.3	187	158.6	99.1	247	209.5	130.9
8	06.8	04.2	68	57.7	36.0	128	108.6	67.8	188	159.4	99.6	248	210.3	131.4
9	07.6	04.8	69	58.5	36.6	129	109.4	68.4	189	160.3	100.2	249	211.2	131.9
10	08.5	05.3	70	59.4	37.1	130	110.2	68.9	190	161.1	100.7	250	212.0	132.5
11	09.3	05.8	71	60.2	37.6	131	111.1	69.4	191	162.0	101.2	251	212.9	133.0
12	10.2	06.4	72	61.1	38.2	132	111.9	69.9	192	162.8	101.7	252	213.7	133.5
13	11.0	06.9	73	61.9	38.7	133	112 8	70.5	193	163.7	102.3	253	214.6	134.1
14	11.9	07 4	74	62.8	39.2	134	113.6	71.0	194	164.5	102.8	254	215.4	134.6
15	12.7	07.9	75	63.6	39.7	135	114.5	71.5	195	165.4	103.3	255	216.3	135.1
16	13.6	08.5	76	64.5	40.3	136	115 3	72.1	196	166.2	103.9	256	217.1	135.7
17	14.4	09.0	77	65.3	40.8	137	116.2	72.6	197	167.1	104.4	257	217.9	136.2
18	15.3	09.5	78	66.1	41.3	138	117.0	73.1	198	167.9	104.9	258	218.8	136.7
19	16.1	10.1	79	67.0	41.9	139	117.9	73.7	199	168.8	105.5	259	219.6	137.2
20	17.0	10.6	80	67.8	42.4	140	118.7	74.2	200	169.6	106.0	260	220.5	137 8
21	17.8	11.1	81	63.7	42.9	141	119.6	74.7	201	170.5	106.5	261	221.3	138.3
22	18.7	11.7	82	69.5	43.5	142	120.4	75 2	202	171.3	107.0	262	222.2	138.8
23	19.5	12.2	83	70.4	44.0	143	121.3	75.8	203	172.2	107.6	263	223.0	139.4
24	20.4	12.7	84	71.2	44.5	144	122.1	76.3	204	173.0	108.1	264	223.9	139.9
25	21.2	13.2	85	72.1	45.0	145	123.0	76.8	205	173.8	108 6	265	224.7	140.4
26	22.0	13.8	86	72.9	45.6	146	123.8	77.4	206	174.7	109.2	266	225.6	141.0
27	22.9	14.3	87	73.8	46.1	147	124.7	77.9	207	175.5	109.7	267	226.4	141.5
28	23.7	14.8	88	74.6	46.6	148	125.5	78.4	208	176.4	110.2	268	227.3	142.0
29	24.6	15.4	89	75.5	47.2	149	126.4	79.0	209	177.2	110.8	269	228.1	142.5
30	25.4	15.9	90	76.3	47.7	150	127.2	79.5	210	178.1	111.3	270	229.0	143.1
31	26.3	16.4	91	77.2	48.2	151	128.1	80.0	211	178.9	111.8	271	229.8	143.6
32	27.1	17.0	92	78.0	48.8	152	128.9	80.5	212	179.8	112.3	272	230.7	144.1
33	28.0	17.5	93	78.9	49.3	153	129.8	81.1	213	180.6	112.9	273	231.5	144.7
34	28.8	18.0	94	79.7	49.8	154	130.6	81.6	214	181.5	113.4	274	232.4	145.2
35	29.7	18.5	95	80.6	50.3	155	131.4	82.1	215	182.3	113.9	275	233.2	145.7
36	30.5	19.1	96	81.4	50.9	156	132.3	82.7	216	183.2	114.5	276	234.1	146.3
37	31.4	19.6	97	82.3	51.4	157	133.1	83.2	217	184.0	115.0	277	234.9	146.8
38	32.2	20.1	98	83.1	51.9	158	134.0	83.7	218	184.9	115.5	278	235.8	147.3
39	33.1	20.7	99	84.0	52.5	159	134.8	84.3	219	185.7	116.1	279	236.6	147 8
40	33.9	21.2	100	84.8	53.0	160	135.7	84.8	220	186.6	116.6	280	237.5	148.4
41	34.8	21.7	101	85.7	53.5	161	136.5	85.3	221	187.4	117.1	281	238.3	148.9
42	35.6	22.3	102	86.5	54.1	162	137.4	85.8	222	188.3	117.6	282	239.1	149.4
43	36.5	22.8	103	87.3	54.6	163	138.2	86.4	223	189.1	118.2	283	240.0	150.0
44	37.3	23.3	104	88.2	55.1	164	139.1	86.9	224	190.0	118.7	284	240.8	150.5
45	38.2	23.8	105	89.0	55.6	165	139.9	87.4	225	190.8	119.2	285	241.7	151.0
46	39.0	24.4	106	89.9	56.2	166	140.8	88.0	226	191.7	119.8	286	242.5	151.6
47	39.9	24.9	107	90.7	56.7	167	141.6	88.5	227	192.5	120.3	287	243.4	152.1
48	40.7	25.4	108	91.6	57.2	168	142.5	89.0	228	193.4	120.8	288	244.2	152.6
49	41.6	26.0	109	92.4	57.8	169	143.3	89.6	229	194.2	121.4	289	245.1	153.1
50	42.4	26.5	110	93.3	58.3	170	144.2	90.1	230	195.1	121.9	290	245.9	153.7
51	43.3	27.0	111	94.1	58.8	171	145.0	90.6	231	195.9	122.4	291	246.8	154.2
52	44.1	27.6	112	95.0	59.4	172	145.9	91.1	232	196.7	122.9	292	247.6	154.7
53	44.9	28.1	113	95.8	59.9	173	146.7	91.7	233	197.6	123.5	293	248.5	155.3
54	45.8	28.6	114	96.7	60.4	174	147.6	92.2	234	198.4	124.0	294	249.3	155.8
55	46.6	29.1	115	97.5	60.9	175	148.4	92.7	235	199.3	124.5	295	250.2	156.3
56	47.5	29.7	116	98.4	61.5	176	149.3	93.3	236	200.1	125.1	296	251.0	156.9
57	48.3	30.2	117	99.2	62.0	177	150.1	93.8	237	201.0	125.6	297	251.9	157.4
58	49.2	30.7	118	100.1	62.5	178	151.0	94.3	238	201.8	126.1	298	252.7	157.9
59	50.0	31.3	119	100.9	63.1	179	151.8	94.9	239	202.7	126.7	299	253.6	158.4
60	50.9	31 8	120	101.8	63.6	180	152.6	95.4	240	203.5	127.2	300	254.4	159.0
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 58 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 33 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.5	61	51.2	33.2	121	101.5	65.9	181	151.8	98.6	241	202.1	131.3
2	01.7	01.1	62	52.0	33.8	122	102.3	66.4	182	152.6	99.1	242	203.0	131.8
3	02.5	01.6	63	52.8	34.3	123	103.2	67.0	183	153.5	99.7	243	203.8	132.3
4	03.4	02.2	64	53.7	34.9	124	104.0	67.5	184	154.3	100.2	244	204.6	132.9
5	04.2	02.7	65	54.5	35.4	125	104.8	68.1	185	155.2	100.8	245	205.5	133.4
6	05.0	03.3	66	55.4	35.9	126	105.7	68.6	186	156.0	101.3	246	206.3	134.0
7	05.9	03.8	67	56.2	36.5	127	106.5	69.2	187	156.8	101.8	247	207.2	134.5
8	06.7	04.4	68	57.0	37.0	128	107.3	69.7	188	157.7	102.4	248	208.0	135.1
9	07.5	04.9	69	57.9	37.6	129	108.2	70.3	189	158.5	102.9	249	208.8	135.6
10	08.4	05.4	70	58.7	38.1	130	109.0	70.8	190	159.3	103.5	250	209.7	136.2
11	09.2	06.0	71	59.5	38.7	131	109.9	71.3	191	160.2	104.0	251	210.5	136.7
12	10.1	06.5	72	60.4	39.2	132	110.7	71.9	192	161.0	104.6	252	211.3	137.2
13	10.9	07.1	73	61.2	39.8	133	111.5	72.4	193	161.9	105.1	253	212.2	137.8
14	11.7	07.6	74	62.1	40.3	134	112.4	73.0	194	162.7	105.7	254	213.0	138.3
15	12.6	08.2	75	62.9	40.8	135	113.2	73.5	195	163.5	106.2	255	213.9	138.9
16	13.4	08.7	76	63.7	41.4	136	114.1	74.1	196	164.4	106.7	256	214.7	139.4
17	14.3	09.3	77	64.6	41.9	137	114.9	74.6	197	165.2	107.3	257	215.5	140.0
18	15.1	09.8	78	65.4	42.5	138	115.7	75.2	198	166.1	107.8	258	216.4	140.5
19	15.9	10.3	79	66.3	43.0	139	116.6	75.7	199	166.9	108.4	259	217.2	141.1
20	16.8	10.9	80	67.1	43.6	140	117.4	76.2	200	167.7	108.9	260	218.1	141.6
21	17.6	11.4	81	67.9	44.1	141	118.3	76.8	201	168.6	109.5	261	218.9	142.2
22	18.5	12.0	82	68.8	44.7	142	119.1	77.3	202	169.4	110.0	262	219.7	142.7
23	19.3	12.5	83	69.6	45.2	143	119.9	77.9	203	170.3	110.6	263	220.6	143.2
24	20.1	13.1	84	70.4	45.7	144	120.8	78.4	204	171.1	111.1	264	221.4	143.8
25	21.0	13.6	85	71.3	46.3	145	121.6	79.0	205	171.9	111.7	265	222.2	144.3
26	21.8	14.2	86	72.1	46.8	146	122.4	79.5	206	172.8	112.2	266	223.1	144.9
27	22.6	14.7	87	73.0	47.4	147	123.3	80.1	207	173.6	112.7	267	223.9	145.4
28	23.5	15.2	88	73.8	47.9	148	124.1	80.6	208	174.4	113.3	268	224.8	146.0
29	24.3	15.8	89	74.6	48.5	149	125.0	81.2	209	175.3	113.8	269	225.6	146.5
30	25.2	16.3	90	75.5	49.0	150	125.8	81.7	210	176.1	114.4	270	226.4	147.1
31	26.0	16.9	91	76.3	49.6	151	126.6	82.2	211	177.0	114.9	271	227.3	147.6
32	26.8	17.4	92	77.2	50.1	152	127.5	82.8	212	177.8	115.5	272	228.1	148.1
33	27.7	18.0	93	78.0	50.7	153	128.3	83.3	213	178.6	116.0	273	229.0	148.7
34	28.5	18.5	94	78.8	51.2	154	129.2	83.9	214	179.5	116.6	274	229.8	149.2
35	29.4	19.1	95	79.7	51.7	155	130.0	84.4	215	180.3	117.1	275	230.6	149.8
36	30.2	19.6	96	80.5	52.3	156	130.8	85.0	216	181.2	117.6	276	231.5	150.3
37	31.0	20.2	97	81.4	52.8	157	131.7	85.5	217	182.0	118.2	277	232.3	150.9
38	31.9	20.7	98	82.2	53.4	158	132.5	86.1	218	182.8	118.7	278	233.2	151.4
39	32.7	21.2	99	83.0	53.9	159	133.3	86.6	219	183.7	119.3	279	234.0	152.0
40	33.5	21.8	100	83.9	54.5	160	134.2	87.1	220	184.5	119.8	280	234.8	152.5
41	34.4	22.3	101	84.7	55.0	161	135.0	87.7	221	185.3	120.4	281	235.7	153.0
42	35.2	22.9	102	85.5	55.6	162	135.9	88.2	222	186.2	120.9	282	236.5	153.6
43	36.1	23.4	103	86.4	56.1	163	136.7	88.8	223	187.0	121.5	283	237.3	154.1
44	36.9	24.0	104	87.2	56.6	164	137.5	89.3	224	187.9	122.0	284	238.2	154.7
45	37.7	24.5	105	88.1	57.2	165	138.4	89.9	225	188.7	122.5	285	239.0	155.2
46	38.6	25.1	106	88.9	57.7	166	139.2	90.4	226	189.5	123.1	286	239.9	155.8
47	39.4	25.6	107	89.7	58.3	167	140.1	91.0	227	190.4	123.6	287	240.7	156.3
48	40.3	26.1	108	90.6	58.8	168	140.9	91.5	228	191.2	124.2	288	241.5	156.9
49	41.1	26.7	109	91.4	59.4	169	141.7	92.0	229	192.1	124.7	289	242.4	157.4
50	41.9	27.2	110	92.3	59.9	170	142.6	92.6	230	192.9	125.3	290	243.2	157.9
51	42.8	27.8	111	93.1	60.5	171	143.4	93.1	231	193.7	125.8	291	244.1	158.5
52	43.6	28.3	112	93.9	61.0	172	144.3	93.7	232	194.6	126.4	292	244.9	159.0
53	44.4	28.9	113	94.8	61.5	173	145.1	94.2	233	195.4	126.9	293	245.7	159.6
54	45.3	29.4	114	95.6	62.1	174	145.9	94.8	234	196.2	127.4	294	246.6	160.1
55	46.1	30.0	115	96.4	62.6	175	146.8	95.3	235	197.1	128.0	295	247.4	160.7
56	47.0	30.5	116	97.3	63.2	176	147.6	95.9	236	197.9	128.5	296	248.2	161.2
57	47.8	31.0	117	98.1	63.7	177	148.4	96.4	237	198.8	129.1	297	249.1	161.8
58	48.6	31.6	118	99.0	64.3	178	149.3	96.9	238	199.6	129.6	298	249.9	162.3
59	49.5	32.1	119	99.8	64.8	179	150.1	97.5	239	200.4	130.2	299	250.8	162.8
60	50.3	32.7	120	100.6	65.4	180	151.0	98.0	240	201.3	130.7	300	251.6	163.4
Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 57 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 34 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.6	61	50.6	34.1	121	100.3	67.7	181	150.1	101.2	241	199.8	134.8
2	01.7	01.1	62	51.4	34 7	122	101.1	68.2	182	150.9	101.8	242	200.6	135.3
3	02.5	01.7	63	52.2	35.2	123	102.0	68.8	183	151.7	102.3	243	201.5	135.9
4	03.3	02.2	64	53.1	35.8	124	102.8	69.3	184	152.5	102.9	244	202.3	136.4
5	04.1	02.8	65	53.9	36.3	125	103.6	69.9	185	153.4	103.5	245	203.1	137.0
6	05.0	03.4	66	54.7	36.9	126	104.5	70.5	186	154.2	104.0	246	203.9	137.6
7	05.8	03.9	67	55.5	37 5	127	105.3	71.0	187	155.0	104.6	247	204.8	138.1
8	06.6	04.5	68	56.4	38.0	128	106.1	71.6	188	155 9	105.1	248	205.6	138.7
9	07.5	05.0	69	57.2	38.6	129	106.9	72.1	189	156.7	105.7	249	206.4	139.2
10	08.3	05.6	70	58.0	39.1	130	107 8	72.7	190	157.5	106.2	250	207.3	139 8
11	09 1	06.2	71	58.9	39.7	131	108.6	73.3	191	158.3	106.8	251	208.1	140.4
12	09.9	06.7	72	59.7	40.3	132	109.4	73.8	192	159.2	107.4	252	208.9	140.9
13	10.8	07.3	73	60.5	40.8	133	110.3	74.4	193	160.0	107.9	253	209.7	141.5
14	11.6	07.8	74	61.3	41.4	134	111.1	74.9	194	160.8	108 5	254	210.6	142.0
15	12.4	08.4	75	62 2	41.9	135	111.9	75.5	195	161.7	109.0	255	211.4	142.6
16	13.3	08.9	76	63 0	42.5	136	112.7	76.1	196	162.5	109.6	256	212.2	143.2
17	14.1	09.5	77	63.8	43.1	137	113.6	76.6	197	163.3	110.2	257	213.1	143.7
18	14.9	10.1	78	64.7	43.6	138	114.4	77.2	198	164.1	110.7	258	213.9	144.3
19	15.8	10 6	79	65.5	44.2	139	115.2	77 7	199	165.0	111.3	259	214.7	144.8
20	16.6	11.2	80	66.3	44.7	140	116.1	78.3	200	165.8	111.8	260	215.5	145.4
21	17.4	11.7	81	67.2	45.3	141	116.9	78.8	201	166.6	112.4	261	216.4	145.9
22	18 2	12.3	82	68 0	45.9	142	117.7	79.4	202	167.5	113 0	262	217.2	146.5
23	19.1	12.9	83	68.8	46.4	143	118.6	80 0	203	168.3	113.5	263	218.0	147.1
24	19.9	13.4	84	69.6	47.0	144	119.4	80.5	204	169.1	114.1	264	218 9	147.6
25	20.7	14.0	85	70.5	47.5	145	120.2	81.1	205	170.0	114.6	265	219.7	148.2
26	21.6	14.5	86	71.3	48.1	146	121.0	81.6	206	170.8	115.2	266	220.5	148.7
27	22.4	15.1	87	72.1	48.6	147	121.9	82.2	207	171.6	115.8	267	221.4	149.3
28	23.2	15.7	88	73.0	49.2	148	122.7	82.8	208	172.4	116.3	268	222.2	149 9
29	24.0	16.2	89	73.8	49.8	149	123.5	83.3	209	173.3	116.9	269	223.0	150.4
30	24.9	16.8	90	74 6	50.3	150	124.4	83.9	210	174.1	117.4	270	223.8	151.0
31	25.7	17.3	91	75.4	50.9	151	125.2	84.4	211	174.9	118.0	271	224.7	151.5
32	26.5	17.9	92	76.3	51.4	152	126.0	85.0	212	175.8	118.5	272	225.5	152.1
33	27.4	18.5	93	77.1	52.0	153	126.8	85.6	213	176.6	119.1	273	226.3	152.7
34	28.2	19.0	94	77.9	52.6	154	127.7	86.1	214	177.4	119.7	274	227.2	153.2
35	29.0	19.6	95	78.8	53.1	155	128.5	86.7	215	178.2	120.2	275	228.0	153.8
36	29.8	20.1	96	79.6	53.7	156	129.3	87 2	216	179.1	120.8	276	228.8	154.3
37	30.7	20.7	97	80.4	54.2	157	130.2	87.8	217	179.9	121.3	277	229 6	154.9
38	31.5	21.2	98	81.2	54.8	158	131.0	88.4	218	180.7	121.9	278	230.5	155.5
39	32.3	21 8	99	82.1	55.4	159	131.8	88.9	219	181.6	122.5	279	231.3	156.0
40	33.2	22.4	100	82.9	55.9	160	132.6	89.5	220	182.4	123.0	280	232.1	156.6
41	34.0	22.9	101	83.7	56.5	161	133.5	90.0	221	183.2	123.6	281	233.0	157.1
42	34.8	23.5	102	84.6	57.0	162	134.3	90.6	222	184.0	124.1	282	233.8	157.7
43	35.6	24.0	103	85.4	57.6	163	135.1	91.1	223	184.9	124.7	283	234.6	158.3
44	36.5	24.6	104	86.2	58.2	164	136.0	91.7	224	185.7	125.3	284	235.4	158.8
45	37.3	25.2	105	87.0	58.7	165	136.8	92.3	225	186.5	125 8	285	236.3	159.4
46	38.1	25.7	106	87.9	59.3	166	137.6	92.8	226	187.4	126.4	286	237.1	159.9
47	39.0	26.3	107	88.7	59.8	167	138 4	93.4	227	188.2	126.9	287	237.9	160.5
48	39.8	26.8	108	89.5	60.4	168	139.3	93.9	228	189.0	127.5	288	238.8	161.0
49	40.6	27.4	109	90.4	61.0	169	140.1	94.5	229	189.8	128 1	289	239.6	161.6
50	41.5	28.0	110	91.2	61.5	170	140.9	95.1	230	190.7	128.6	290	240.4	162.2
51	42.3	28.5	111	92.0	62.1	171	141.8	95.6	231	191.5	129.2	291	241.2	162.7
52	43.1	29.1	112	92.9	62.6	172	142.6	96.2	232	192.3	129.7	292	242.1	163 3
53	43.9	29.6	113	93.7	63.2	173	143.4	96.7	233	193.2	130.3	293	242.9	163.8
54	44.8	30.2	114	94.5	63.7	174	144.3	97.3	234	194.0	130.9	294	243.7	164.4
55	45.6	30.8	115	95.3	64.3	175	145.1	97.9	235	194.8	131.4	295	244.6	165.0
56	46.4	31.3	116	96.2	64.9	176	145.9	98.4	236	195.7	132.0	296	245.4	165.5
57	47.3	31.9	117	97.0	65.4	177	146.7	99.0	237	196.5	132.5	297	246.2	166.1
58	48.1	32.4	118	97.8	66.0	178	147.6	99.5	238	197.3	133.1	298	247.1	166.6
59	48 9	33.0	119	98.7	66.5	179	148.4	100.1	239	198.1	133.6	299	247.9	167.2
60	49.7	33.6	120	99.5	67.1	180	149.2	100.7	240	199.0	134.2	300	248.7	167.8
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 56 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 35 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.6	61	50.0	35.0	121	99.1	69.4	181	148.3	103.8	241	197.4	138.2
2	01.6	01.1	62	50.8	35.6	122	99.9	70.0	182	149.1	104.4	242	198.2	138.8
3	02.5	01.7	63	51.6	36.1	123	100.8	70.5	183	149.9	105.0	243	199.1	139.4
4	03.3	02.3	64	52.4	36.7	124	101.6	71.1	184	150.7	105.5	244	199.9	140.0
5	04.1	02.9	65	53.2	37.3	125	102.4	71.7	185	151.5	106.1	245	200.7	140.5
6	04.9	03.4	66	54.1	37.9	126	103.2	72.3	186	152.4	106.7	246	201.5	141.1
7	05.7	04.0	67	54.9	38.4	127	104.0	72.8	187	153.2	107.3	247	202.3	141.7
8	06.6	04.6	68	55.7	39.0	128	104.9	73.4	188	154.0	107.8	248	203.1	142.2
9	07.4	05.2	69	56.5	39.6	129	105.7	74.0	189	154.8	108.4	249	204.0	142.8
10	08.2	05.7	70	57.3	40.2	130	106.5	74.6	190	155.6	109.0	250	204.8	143.4
11	09.0	06.3	71	58.2	40.7	131	107.3	75.1	191	156.5	109.6	251	205.6	144.0
12	09.8	06.9	72	59.0	41.3	132	108.1	75.7	192	157.3	110.1	252	206.4	144.5
13	10.6	07.5	73	59.8	41.9	133	108.9	76.3	193	158.1	110.7	253	207.2	145.1
14	11.5	08.0	74	60.6	42.4	134	109.8	76.9	194	158.9	111.3	254	208.1	145.7
15	12.3	08.6	75	61.4	43.0	135	110.6	77.4	195	159.7	111.8	255	208.9	146.3
16	13.1	09.2	76	62.3	43.6	136	111.4	78.0	196	160.6	112.4	256	209.7	146.8
17	13.9	09.8	77	63.1	44.2	137	112.2	78.6	197	161.4	113.0	257	210.5	147.4
18	14.7	10.3	78	63.9	44.7	138	113.0	79.2	198	162.2	113.6	258	211.3	148.0
19	15.6	10.9	79	64.7	45.3	139	113.9	79.7	199	163.0	114.1	259	212.2	148.6
20	16.4	11.5	80	65.5	45.9	140	114.7	80.3	200	163.8	114.7	260	213.0	149.1
21	17.2	12.0	81	66.4	46.5	141	115.5	80.9	201	164.6	115.3	261	213.8	149.7
22	18.0	12.6	82	67.2	47.0	142	116.3	81.4	202	165.5	115.9	262	214.6	150.3
23	18.8	13.2	83	68.0	47.6	143	117.1	82.0	203	166.3	116.4	263	215.4	150.9
24	19.7	13.8	84	68.8	48.2	144	118.0	82.6	204	167.1	117.0	264	216.3	151.4
25	20.5	14.3	85	69.6	48.8	145	118.8	83.2	205	167.9	117.6	265	217.1	152.0
26	21.3	14.9	86	70.4	49.3	146	119.6	83.7	206	168.7	118.2	266	217.9	152.6
27	22.1	15.5	87	71.3	49.9	147	120.4	84.3	207	169.6	118.7	267	218.7	153.1
28	22.9	16.1	88	72.1	50.5	148	121.2	84.9	208	170.4	119.3	268	219.5	153.7
29	23.8	16.6	89	72.9	51.0	149	122.1	85.5	209	171.2	119.9	269	220.4	154.3
30	24.6	17.2	90	73.7	51.6	150	122.9	86.0	210	172.0	120.5	270	221.2	154.9
31	25.4	17.8	91	74.5	52.2	151	123.7	86.6	211	172.8	121.0	271	222.0	155.4
32	26.2	18.4	92	75.4	52.8	152	124.5	87.2	212	173.7	121.6	272	222.8	156.0
33	27.0	18.9	93	76.2	53.3	153	125.3	87.8	213	174.5	122.2	273	223.6	156.6
34	27.9	19.5	94	77.0	53.9	154	126.1	88.3	214	175.3	122.7	274	224.4	157.2
35	28.7	20.1	95	77.8	54.5	155	127.0	88.9	215	176.1	123.3	275	225.3	157.7
36	29.5	20.6	96	78.6	55.1	156	127.8	89.5	216	176.9	123.9	276	226.1	158.3
37	30.3	21.2	97	79.5	55.6	157	128.6	90.1	217	177.8	124.5	277	226.9	158.9
38	31.1	21.8	98	80.3	56.2	158	129.4	90.6	218	178.6	125.0	278	227.7	159.5
39	31.9	22.4	99	81.1	56.8	159	130.2	91.2	219	179.4	125.6	279	228.5	160.0
40	32.8	22.9	100	81.9	57.4	160	131.1	91.8	220	180.2	126.2	280	229.4	160.6
41	33.6	23.5	101	82.7	57.9	161	131.9	92.3	221	181.0	126.8	281	230.2	161.2
42	34.4	24.1	102	83.6	58.5	162	132.7	92.9	222	181.9	127.3	282	231.0	161.7
43	35.2	24.7	103	84.4	59.1	163	133.5	93.5	223	182.7	127.9	283	231.8	162.3
44	36.0	25.2	104	85.2	59.7	164	134.3	94.1	224	183.5	128.5	284	232.6	162.9
45	36.9	25.8	105	86.0	60.2	165	135.2	94.6	225	184.3	129.1	285	233.5	163.5
46	37.7	26.4	106	86.8	60.8	166	136.0	95.2	226	185.1	129.6	286	234.3	164.0
47	38.5	27.0	107	87.6	61.4	167	136.8	95.8	227	185.9	130.2	287	235.1	164.6
48	39.3	27.5	108	88.5	61.9	168	137.6	96.4	228	186.8	130.8	288	235.9	165.2
49	40.1	28.1	109	89.3	62.5	169	138.4	96.9	229	187.6	131.3	289	236.7	165.8
50	41.0	28.7	110	90.1	63.1	170	139.3	97.5	230	188.4	131.9	290	237.6	166.3
51	41.8	29.3	111	90.9	63.7	171	140.1	98.1	231	189.2	132.5	291	238.4	166.9
52	42.6	29.8	112	91.7	64.2	172	140.9	98.7	232	190.0	133.1	292	239.2	167.5
53	43.4	30.4	113	92.6	64.8	173	141.7	99.2	233	190.9	133.6	293	240.0	168.1
54	44.2	31.0	114	93.4	65.4	174	142.5	99.8	234	191.7	134.2	294	240.8	168.6
55	45.1	31.5	115	94.2	66.0	175	143.4	100.4	235	192.5	134.8	295	241.6	169.2
56	45.9	32.2	116	95.0	66.5	176	144.2	100.9	236	193.3	135.4	296	242.5	169.8
57	46.7	32.7	117	95.8	67.1	177	145.0	101.5	237	194.1	135.9	297	243.3	170.4
58	47.5	33.3	118	96.7	67.7	178	145.8	102.1	238	195.0	136.5	298	244.1	170.9
59	48.3	33.8	119	97.5	68.3	179	146.6	102.7	239	195.8	137.1	299	244.9	171.5
60	49.1	34.4	120	98.3	68.8	180	147.4	103.2	240	196.6	137.7	300	245.7	172.1
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 55 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 36 DEGREES.

Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.6	61	49.4	35.9	121	97.9	71.1	181	146.4	106.4	241	195.0	141.7
2	01.6	01.2	62	50.2	36.4	122	98.7	71.7	182	147.2	107.0	242	195.8	142.2
3	02.4	01.8	63	51.0	37.0	123	99.5	72.3	183	148.1	107.6	243	196.6	142.8
4	03.2	02.4	64	51.8	37.6	124	100.3	72.9	184	148.9	108.2	244	197.4	143.4
5	04.0	02.9	65	52.6	38.2	125	101.1	73.5	185	149.7	108.7	245	198.2	144.0
6	04.9	03.5	66	53.4	38.8	126	101.9	74.1	186	150.5	109.3	246	199.0	144.6
7	05.7	04.1	67	54.2	39.4	127	102.7	74.6	187	151.3	109.9	247	199.8	145.2
8	06.5	04.7	68	55.0	40.0	128	103.6	75.2	188	152.1	110.5	248	200.6	145.8
9	07.3	05.3	69	55.8	40.6	129	104.4	75.8	189	152.9	111.1	249	201.4	146.4
10	08.1	05.9	70	56.6	41.1	130	105.2	76.4	190	153.7	111.7	250	202.3	146.9
11	08.9	06.5	71	57.4	41.7	131	106.0	77.0	191	154.5	112.3	251	203.1	147.5
12	09.7	07.1	72	58.2	42.3	132	106.8	77.6	192	155.3	112.9	252	203.9	148.1
13	10.5	07.6	73	59.1	42.9	133	107.6	78.2	193	156.1	113.4	253	204.7	148.7
14	11.3	08.2	74	59.9	43.5	134	108.4	78.8	194	156.9	114.0	254	205.5	149.3
15	12.1	08.8	75	60.7	44.1	135	109.2	79.4	195	157.8	114.6	255	206.3	149.9
16	12.9	09.4	76	61.5	44.7	136	110.0	79.9	196	158.6	115.2	256	207.1	150.5
17	13.8	10.0	77	62.3	45.3	137	110.8	80.5	197	159.4	115.8	257	207.9	151.1
18	14.6	10.6	78	63.1	45.8	138	111.6	81.1	198	160.2	116.4	258	208.7	151.6
19	15.4	11.2	79	63.9	46.4	139	112.5	81.7	199	161.0	117.0	259	209.5	152.2
20	16.2	11.8	80	64.7	47.0	140	113.3	82.3	200	161.8	117.6	260	210.3	152.8
21	17.0	12.3	81	65.5	47.6	141	114.1	82.9	201	162.6	118.1	261	211.2	153.4
22	17.8	12.9	82	66.3	48.2	142	114.9	83.5	202	163.4	118.7	262	212.0	154.0
23	18.6	13.5	83	67.1	48.8	143	115.7	84.1	203	164.2	119.3	263	212.8	154.6
24	19.4	14.1	84	63.0	49.4	144	116.5	84.6	204	165.0	119.9	264	213.6	155.2
25	20.2	14.7	85	68.8	50.0	145	117.3	85.2	205	165.8	120.5	265	214.4	155.8
26	21.0	15.3	86	69.6	50.5	146	118.1	85.8	206	166.7	121.1	266	215.2	156.4
27	22.8	15.9	87	70.4	51.1	147	118.9	86.4	207	167.5	121.7	267	216.0	156.9
28	22.7	16.5	88	71.2	51.7	148	119.7	87.0	208	168.3	122.3	268	216.8	157.5
29	23.5	17.0	89	72.0	52.3	149	120.5	87.6	209	169.1	122.8	269	217.6	158.1
30	24.3	17.6	90	72.8	52.9	150	121.4	88.2	210	169.9	123.4	270	218.4	158.7
31	25.1	18.2	91	73.6	53.5	151	122.2	88.8	211	170.7	124.0	271	219.2	159.3
32	25.9	18.8	92	74.4	54.1	152	123.0	89.3	212	171.5	124.6	272	220.1	159.9
33	26.7	19.4	93	75.2	54.7	153	123.8	89.9	213	172.3	125.2	273	220.9	160.5
34	27.5	20.0	94	76.0	55.3	154	124.6	90.5	214	173.1	125.8	274	221.7	161.1
35	28.3	20.6	95	76.9	55.8	155	125.4	91.1	215	173.9	126.4	275	222.5	161.6
36	29.1	21.2	96	77.7	56.4	156	126.2	91.7	216	174.7	127.0	276	223.3	162.2
37	29.9	21.7	97	78.5	57.0	157	127.0	92.3	217	175.6	127.5	277	224.1	162.8
38	30.7	22.3	98	79.3	57.6	158	127.8	92.9	218	176.4	128.1	278	224.9	163.4
39	31.6	22.9	99	80.1	58.2	159	128.6	93.5	219	177.2	128.7	279	225.7	164.0
40	32.4	23.5	100	80.9	58.8	160	129.4	94.0	220	178.0	129.3	280	226.5	164.6
41	33.2	24.1	101	81.7	59.4	161	130.3	94.6	221	178.8	129.9	281	227.3	165.2
42	34.0	24.7	102	82.5	60.0	162	131.1	95.2	222	179.6	130.5	282	228.1	165.8
43	34.8	25.3	103	83.3	60.5	163	131.9	95.8	223	180.4	131.1	283	229.0	166.3
44	35.6	25.9	104	84.1	61.1	164	132.7	96.4	224	181.2	131.7	284	229.8	166.9
45	36.4	26.5	105	84.9	61.7	165	133.5	97.0	225	182.0	132.3	285	230.6	167.5
46	37.2	27.0	106	85.8	62.3	166	134.3	97.6	226	182.8	132.8	286	231.4	168.1
47	38.0	27.6	107	86.6	62.9	167	135.1	98.2	227	183.6	133.4	287	232.2	168.7
48	38.8	28.2	108	87.4	63.5	168	135.9	98.7	228	184.5	134.0	288	233.0	169.3
49	39.6	28.8	109	88.2	64.1	169	136.7	99.3	229	185.3	134.6	289	233.8	169.9
50	40.5	29.4	110	89.0	64.7	170	137.5	99.9	230	186.1	135.2	290	234.6	170.5
51	41.3	30.0	111	89.8	65.2	171	138.3	100.5	231	186.9	135.8	291	235.4	171.0
52	42.1	30.6	112	90.6	65.8	172	139.2	101.1	232	187.7	136.4	292	236.2	171.6
53	42.9	31.2	113	91.4	66.4	173	140.0	101.7	233	188.5	137.0	293	237.0	172.2
54	43.7	31.7	114	92.2	67.0	174	140.8	102.3	234	189.3	137.5	294	237.9	172.8
55	44.5	32.3	115	93.0	67.6	175	141.6	102.9	235	190.1	138.1	295	238.7	173.4
56	45.3	32.9	116	93.8	68.2	176	142.4	103.5	236	190.9	138.7	296	239.5	174.0
57	46.1	33.5	117	94.7	68.8	177	143.2	104.0	237	191.7	139.3	297	240.3	174.6
58	46.9	34.1	118	95.5	69.4	178	144.0	104.6	238	192.5	139.9	298	241.1	175.2
59	47.7	34.7	119	96.3	69.9	179	144.8	105.2	239	193.4	140.5	299	241.9	175.7
60	48.5	35.3	120	97.1	70.5	180	145.6	105.8	240	194.2	141.1	300	242.7	176.3
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 54 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 37 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.6	61	48.7	36.7	121	96.6	72.8	181	144.6	108.9	241	192.5	145.0
2	01.6	01.2	62	49.5	37.3	122	97.4	73.4	182	145.4	109.5	242	193.3	145.6
3	02.4	01.8	63	50.3	37.9	123	98.2	74.0	183	146.2	110.1	243	194.1	146.2
4	03.2	02.4	64	51.1	38.5	124	99.0	74.6	184	146.9	110.7	244	194.9	146.8
5	04.0	03.0	65	51.9	39.1	125	99.8	75.2	185	147.7	111.3	245	195.7	147.4
6	04.8	03.6	66	52.7	39.7	126	100.6	75.8	186	148.5	111.9	246	196.5	148.0
7	05.6	04.2	67	53.5	40.3	127	101.4	76.4	187	149.3	112.5	247	197.3	148.6
8	06.4	04.8	68	54.3	40.9	128	102.2	77.0	188	150.1	113.1	248	198.1	149.3
9	07.2	05.4	69	55.1	41.5	129	103.0	77.6	189	150.9	113.7	249	198.9	149.9
10	08.0	06.0	70	55.9	42.1	130	103.8	78.2	190	151.7	114.3	250	199.7	150.5
11	08.8	06.6	71	56.7	42.7	131	104.6	78.8	191	152.5	114.9	251	200.5	151.1
12	09.6	07.2	72	57.5	43.3	132	105.4	79.4	192	153.3	115.5	252	201.3	151.7
13	10.4	07.8	73	58.3	43.9	133	106.2	80.0	193	154.1	116.2	253	202.1	152.3
14	11.2	08.4	74	59.1	44.5	134	107.0	80.6	194	154.9	116.8	254	202.9	152.9
15	12.0	09.0	75	59.9	45.1	135	107.8	81.2	195	155.7	117.4	255	203.7	153.5
16	12.8	09.6	76	60.7	45.7	136	108.6	81.8	196	156.5	118.0	256	204.5	154.1
17	13.6	10.2	77	61.5	46.3	137	109.4	82.4	197	157.3	118.6	257	205.2	154.7
18	14.4	10.8	78	62.3	46.9	138	110.2	83.1	198	158.1	119.2	258	206.0	155.3
19	15.2	11.4	79	63.1	47.5	139	111.0	83.7	199	158.9	119.8	259	206.8	155.9
20	16.0	12.0	80	63.9	48.1	140	111.8	84.3	200	159.7	120.4	260	207.6	156.5
21	16.8	12.6	81	64.7	48.7	141	112.6	84.9	201	160.5	121.0	261	208.4	157.1
22	17.6	13.2	82	65.5	49.3	142	113.4	85.5	202	161.3	121.6	262	209.2	157.7
23	18.4	13.8	83	66.3	50.0	143	114.2	86.1	203	162.1	122.2	263	210.0	158.3
24	19.2	14.4	84	67.1	50.6	144	115.0	86.7	204	162.9	122.8	264	210.8	158.9
25	20.0	15.0	85	67.9	51.2	145	115.8	87.3	205	163.7	123.4	265	211.6	159.5
26	20.8	15.6	86	68.7	51.8	146	116.6	87.9	206	164.5	124.0	266	212.4	160.1
27	21.6	16.2	87	69.5	52.4	147	117.4	88.5	207	165.3	124.6	267	213.2	160.7
28	22.4	16.9	88	70.3	53.0	148	118.2	89.1	208	166.1	125.2	268	214.0	161.3
29	23.2	17.5	89	71.1	53.6	149	119.0	89.7	209	166.9	125.8	269	214.8	161.9
30	24.0	18.1	90	71.9	54.2	150	119.8	90.3	210	167.7	126.4	270	215.6	162.5
31	24.8	18.7	91	72.7	54.8	151	120.6	90.9	211	168.5	127.0	271	216.4	163.1
32	25.6	19.3	92	73.5	55.4	152	121.4	91.5	212	169.3	127.6	272	217.2	163.7
33	26.4	19.9	93	74.3	56.0	153	122.2	92.1	213	170.1	128.2	273	218.0	164.3
34	27.2	20.5	94	75.1	56.6	154	123.0	92.7	214	170.9	128.8	274	218.8	164.9
35	28.0	21.1	95	75.9	57.2	155	123.8	93.3	215	171.7	129.4	275	219.6	165.5
36	28.8	21.7	96	76.7	57.8	156	124.6	93.9	216	172.5	130.0	276	220.4	166.1
37	29.5	22.3	97	77.5	58.4	157	125.4	94.5	217	173.3	130.6	277	221.2	166.7
38	30.3	22.9	98	78.3	59.0	158	126.2	95.1	218	174.1	131.2	278	222.0	167.3
39	31.1	23.5	99	79.1	59.6	159	127.0	95.7	219	174.9	131.8	279	222.8	167.9
40	31.9	24.1	100	79.9	60.2	160	127.8	96.3	220	175.7	132.4	280	223.6	168.5
41	32.7	24.7	101	80.7	60.8	161	128.6	96.9	221	176.5	133.0	281	224.4	169.1
42	33.5	25.3	102	81.5	61.4	162	129.4	97.5	222	177.3	133.6	282	225.2	169.7
43	34.3	25.9	103	82.3	62.0	163	130.2	98.1	223	178.1	134.2	283	226.0	170.3
44	35.1	26.5	104	83.1	62.6	164	131.0	98.7	224	178.9	134.8	284	226.8	170.9
45	35.9	27.1	105	83.9	63.2	165	131.8	99.3	225	179.7	135.4	285	227.6	171.5
46	36.7	27.7	106	84.7	63.8	166	132.6	99.9	226	180.5	136.0	286	228.4	172.1
47	37.5	28.3	107	85.5	64.4	167	133.4	100.5	227	181.3	136.6	287	229.2	172.7
48	38.3	28.9	108	86.3	65.0	168	134.2	101.1	228	182.1	137.2	288	230.0	173.3
49	39.1	29.5	109	87.1	65.6	169	135.0	101.7	229	182.9	137.8	289	230.8	173.7
50	39.9	30.1	110	87.8	66.2	170	135.8	102.3	230	183.7	138.4	290	231.6	174.5
51	40.7	30.7	111	88.6	66.8	171	136.6	102.9	231	184.5	139.0	291	232.4	175.1
52	41.5	31.3	112	89.4	67.4	172	137.4	103.5	232	185.3	139.6	292	233.2	175.7
53	42.3	31.9	113	90.2	68.0	173	138.2	104.1	233	186.1	140.2	293	234.0	176.3
54	43.1	32.5	114	91.0	68.6	174	139.0	104.7	234	186.9	140.8	294	234.8	176.9
55	43.9	33.1	115	91.8	69.2	175	139.8	105.3	235	187.7	141.4	295	235.6	177.5
56	44.7	33.7	116	92.6	69.8	176	140.6	105.9	236	188.5	142.0	296	236.4	178.1
57	45.5	34.3	117	93.4	70.4	177	141.4	106.5	237	189.3	142.6	297	237.2	178.7
58	46.3	34.9	118	94.2	71.0	178	142.2	107.1	238	190.1	143.2	298	238.0	179.3
59	47.1	35.5	119	95.0	71.6	179	143.0	107.7	239	190.9	143.3	299	238.8	179.9
60	47.9	36.1	120	95.8	72.2	180	143.8	108.3	240	191.7	144.4	300	239.6	180.5
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 53 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 38 DEGREES.

Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.6	61	48.1	37.6	121	95.3	74.5	181	142.6	111.4	241	189.9	148.4
2	01.6	01.2	62	48.9	38.2	122	96.1	75.1	182	143.4	112.1	242	190.7	149.0
3	02.4	01.8	63	49.6	38.8	123	96.9	75.7	183	144.2	112.7	243	191.5	149.6
4	03.2	02.5	64	50.4	39.4	124	97.7	76.3	184	145.0	113.3	244	192.3	150.2
5	03.9	03.1	65	51.2	40.0	125	98.5	77.0	185	145.8	113.9	245	193.1	150.8
6	04.7	03.7	66	52.0	40.6	126	99.3	77.6	186	146.6	214.5	246	193.9	151.5
7	05.5	04.3	67	52.8	41.2	127	100.1	78.2	187	147.4	115.1	247	194.6	152.1
8	06.3	04.9	68	53.6	41.9	128	100.9	78.8	188	148.1	115.7	248	195.4	152.7
9	07.1	05.5	69	54.4	42.5	129	101.7	79.4	189	148.9	116.4	249	196.2	153.3
10	07.9	06.2	70	55.2	43.1	130	102.4	80.0	190	149.7	117.0	250	197.0	153.9
11	08.7	06.8	71	55.9	43.7	131	103.2	80.7	191	150.5	117.6	251	197.8	154.5
12	09.5	07.4	72	56.7	44.3	132	104.0	81.3	192	151.3	118.2	252	198.6	155.1
13	10.2	08.0	73	57.5	44.9	133	104.8	81.9	193	152.1	118.8	253	199.4	155.8
14	11.0	08.6	74	58.3	45.6	134	105.6	82.5	194	152.9	119.4	254	200.2	156.4
15	11.8	09.2	75	59.1	46.2	135	106.4	83.1	195	153.7	120.1	255	200.9	157.0
16	12.6	09.9	76	59.9	46.8	136	107.2	83.7	196	154.5	120.7	256	201.7	157.6
17	13.4	10.5	77	60.7	47.4	137	108.0	84.3	197	155.2	121.3	257	202.5	158.2
18	14.2	11.1	78	61.5	48.0	138	108.7	85.0	198	156.0	121.9	258	203.3	158.8
19	15.0	11.7	79	62.3	48.6	139	109.5	85.6	199	156.8	122.5	259	204.1	159.5
20	15.8	12.3	80	63.0	49.3	140	110.3	86.2	200	157.6	123.1	260	204.9	160.1
21	16.5	12.9	81	63.8	49.9	141	111.1	86.8	201	158.4	123.7	261	205.7	160.7
22	17.3	13.5	82	64.6	50.5	142	111.9	87.4	202	159.2	124.4	262	206.5	161.3
23	18.1	14.2	83	65.4	51.1	143	112.7	88.0	203	160.0	125.0	263	207.2	161.9
24	18.9	14.8	84	66.2	51.7	144	113.5	88.7	204	160.8	125.6	264	208.0	162.5
25	19.7	15.4	85	67.0	52.3	145	114.3	89.3	205	161.5	126.2	265	208.8	163.2
26	20.5	16.0	86	67.8	52.9	146	115.0	89.9	206	162.3	126.8	266	209.6	163.8
27	21.3	16.6	87	68.6	53.6	147	115.8	90.5	207	163.1	127.4	267	210.4	164.4
28	22.1	17.2	88	69.3	54.2	148	116.6	91.1	208	163.9	128.1	268	211.2	165.0
29	22.9	17.9	89	70.1	54.8	149	117.4	91.7	209	164.7	128.7	269	212.0	165.6
30	23.6	18.5	90	70.9	55.4	150	118.2	92.3	210	165.5	129.3	270	212.8	166.2
31	24.4	19.1	91	71.7	56.0	151	119.0	93.0	211	166.3	129.9	271	213.6	166.8
32	25.2	19.7	92	72.5	56.6	152	119.8	93.6	212	167.1	130.5	272	214.3	167.5
33	26.0	20.3	93	73.3	57.3	153	120.6	94.2	213	167.8	131.1	273	215.1	168.1
34	26.8	20.9	94	74.1	57.9	154	121.4	94.8	214	168.6	131.8	274	215.9	168.7
35	27.6	21.5	95	74.9	58.5	155	122.1	95.4	215	169.4	132.4	275	216.7	169.3
36	28.4	22.2	96	75.6	59.1	156	122.9	96.0	216	170.2	133.0	276	217.5	169.9
37	29.2	22.8	97	76.4	59.7	157	123.7	96.7	217	171.0	133.6	277	218.3	170.5
38	29.9	23.4	98	77.2	60.3	158	124.5	97.3	218	171.8	134.2	278	219.1	171.2
39	30.7	24.0	99	78.0	61.0	159	125.3	97.9	219	172.6	134.8	279	219.9	171.8
40	31.5	24.6	100	78.8	61.6	160	126.1	98.5	220	173.4	135.4	280	220.6	172.4
41	32.3	25.2	101	79.6	62.2	161	126.9	99.1	221	174.2	136.1	281	221.4	173.0
42	33.1	25.9	102	80.4	62.8	162	127.7	99.7	222	174.9	136.7	282	222.2	173.6
43	33.9	26.5	103	81.2	63.4	163	128.4	100.4	223	175.7	137.3	283	223.0	174.2
44	34.7	27.1	104	82.0	64.0	164	129.2	101.0	224	176.5	137.9	284	223.8	174.8
45	35.5	27.7	105	82.7	64.6	165	130.0	101.6	225	177.3	138.5	285	224.6	175.5
46	36.2	28.3	106	83.5	65.3	166	130.8	102.2	226	178.1	139.1	286	225.4	176.1
47	37.0	28.9	107	84.3	65.9	167	131.6	102.8	227	178.9	139.8	287	226.2	176.7
48	37.8	29.6	108	85.1	66.5	168	132.4	103.4	228	179.7	140.4	288	226.9	177.3
49	38.6	30.2	109	85.9	67.1	169	133.2	104.0	229	180.5	141.0	289	227.7	177.9
50	39.4	30.8	110	86.7	67.7	170	134.0	104.7	230	181.2	141.6	290	228.5	178.5
51	40.2	31.4	111	87.5	68.3	171	134.7	105.3	231	182.0	142.2	291	229.3	179.2
52	41.0	32.0	112	88.3	69.0	172	135.5	105.9	232	182.8	142.8	292	230.1	179.8
53	41.8	32.6	113	89.0	69.6	173	136.3	106.5	233	183.6	143.4	293	230.9	180.4
54	42.6	33.2	114	89.8	70.2	174	137.1	107.1	234	184.4	144.1	294	231.7	181.0
55	43.3	33.9	115	90.6	70.8	175	137.9	107.7	235	185.2	144.7	295	232.5	181.6
56	44.1	34.5	116	91.4	71.4	176	138.7	108.4	236	186.0	145.3	296	233.3	182.2
57	44.9	35.1	117	92.2	72.0	177	139.5	109.0	237	186.8	145.9	297	234.0	182.9
58	45.7	35.7	118	93.0	72.6	178	140.3	109.6	238	187.5	146.5	298	234.8	183.5
59	46.5	36.3	119	93.8	73.3	179	141.1	110.2	239	188.3	147.1	299	235.6	184.1
60	47.3	36.9	120	94.6	73.9	180	141.8	110.8	240	189.1	147.8	300	236.4	184.7
Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 52 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 39 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.6	61	47.4	38.4	121	94.0	76.1	181	140.7	113.9	241	187.3	151.7
2	01.6	01.3	62	48.2	39.0	122	94.8	76.8	182	141.4	114.5	242	188.1	152.3
3	02.3	01.9	63	49.0	39.6	123	95.6	77.4	183	142.2	115.2	243	188.8	152.9
4	03.1	02.5	64	49.7	40.3	124	96.4	78.0	184	143.0	115.8	244	189.6	153.6
5	03.9	03.1	65	50.5	40.9	125	97.1	78.7	185	143.8	116.4	245	190.4	154.2
6	04.7	03.8	66	51.3	41.5	126	97.9	79.3	186	144.5	117.1	246	191.2	154.8
7	05.4	04.4	67	52.1	42.2	127	98.7	79.9	187	145.3	117.7	247	192.0	155.4
8	06.2	05.0	68	52.8	42.8	128	99.5	80.6	188	146.1	118.3	248	192.7	156.1
9	07.0	05.7	69	53.6	43.4	129	100.3	81.2	189	146.9	118.9	249	193.5	156.7
10	07.8	06.3	70	54.4	44.1	130	101.0	81.8	190	147.7	119.6	250	194.3	157.3
11	08.5	06.9	71	55.2	44.7	131	101.8	82.4	191	148.4	120.2	251	195.1	158.0
12	09.3	07.6	72	56.0	45.3	132	102.6	83.1	192	149.2	120.8	252	195.8	158.6
13	10.1	08.2	73	56.7	45.9	133	103.4	83.7	193	150.0	121.5	253	196.6	159.2
14	10.9	08.8	74	57.5	46.6	134	104.1	84.3	194	150.8	122.1	254	197.4	159.8
15	11.7	09.4	75	58.3	47.2	135	104.9	85.0	195	151.5	122.7	255	198.2	160.5
16	12.4	10.1	76	59.1	47.8	136	105.7	85.6	196	152.3	123.3	256	198.9	161.1
17	13.2	10.7	77	59.8	48.5	137	106.5	86.2	197	153.1	124.0	257	199.7	161.7
18	14.0	11.3	78	60.6	49.1	138	107.2	86.8	198	153.9	124.6	258	200.5	162.4
19	14.8	12.0	79	61.4	49.7	139	108.0	87.5	199	154.7	125.2	259	201.3	163.0
20	15.5	12.6	80	62.2	50.3	140	108.8	88.1	200	155.4	125.9	260	202.1	163.6
21	16.3	13.2	81	62.9	51.0	141	109.6	88.7	201	156.2	126.5	261	202.8	164.3
22	17.1	13.8	82	63.7	51.6	142	110.4	89.4	202	157.0	127.1	262	203.6	164.9
23	17.9	14.5	83	64.5	52.2	143	111.1	90.0	203	157.8	127.8	263	204.4	165.5
24	18.7	15.1	84	65.3	52.9	144	111.9	90.6	204	158.5	128.4	264	205.2	166.1
25	19.4	15.7	85	66.1	53.5	145	112.7	91.3	205	159.3	129.0	265	205.9	166.8
26	20.2	16.4	86	66.8	54.1	146	113.5	91.9	206	160.1	129.6	266	206.7	167.4
27	21.0	17.0	87	67.6	54.8	147	114.2	92.5	207	160.9	130.3	267	207.5	168.0
28	21.8	17.6	88	68.4	55.4	148	115.0	93.1	208	161.6	130.9	268	208.3	168.7
29	22.5	18.3	89	69.2	56.0	149	115.8	93.8	209	162.4	131.5	269	209.1	169.3
30	23.3	18.9	90	69.9	56.6	150	116.6	94.4	210	163.2	132.2	270	209.8	169.9
31	24.1	19.5	91	70.7	57.3	151	117.3	95.0	211	164.0	132.8	271	210.6	170.5
32	24.9	20.1	92	71.5	57.9	152	118.1	95.7	212	164.8	133.4	272	211.4	171.2
33	25.6	20.8	93	72.3	58.5	153	118.9	96.3	213	165.5	134.0	273	212.2	171.8
34	26.4	21.4	94	73.1	59.2	154	119.7	96.9	214	166.3	134.7	274	212.9	172.4
35	27.2	22.0	95	73.8	59.8	155	120.5	97.5	215	167.1	135.3	275	213.7	173.1
36	28.0	22.7	96	74.6	60.4	156	121.2	98.2	216	167.9	135.9	276	214.5	173.7
37	28.8	23.3	97	75.4	61.0	157	122.0	98.8	217	168.6	136.6	277	215.3	174.3
38	29.5	23.9	98	76.2	61.7	158	122.8	99.4	218	169.4	137.2	278	216.0	175.0
39	30.3	24.5	99	76.9	62.3	159	123.6	100.1	219	170.2	137.8	279	216.8	175.6
40	31.1	25.2	100	77.7	62.9	160	124.3	100.7	220	171.0	138.5	280	217.6	176.2
41	31.9	25.8	101	78.5	63.6	161	125.1	101.3	221	171.7	139.1	281	218.4	176.8
42	32.6	26.4	102	79.3	64.2	162	125.9	101.9	222	172.5	139.7	282	219.2	177.5
43	33.4	27.1	103	80.0	64.8	163	126.7	102.6	223	173.3	140.3	283	219.9	178.1
44	34.2	27.7	104	80.8	65.4	164	127.5	103.2	224	174.1	141.0	284	220.7	178.7
45	35.0	28.3	105	81.6	66.1	165	128.2	103.8	225	174.9	141.6	285	221.5	179.4
46	35.7	28.9	106	82.4	66.7	166	129.0	104.5	226	175.6	142.2	286	222.3	180.0
47	36.5	29.6	107	83.2	67.3	167	129.8	105.1	227	176.4	142.9	287	223.0	180.6
48	37.3	30.2	108	83.9	68.0	168	130.6	105.7	228	177.2	143.5	288	223.8	181.2
49	38.1	30.8	109	84.7	68.6	169	131.3	106.4	229	178.0	144.1	289	224.6	181.9
50	38.9	31.5	110	85.5	69.2	170	132.1	107.0	230	178.7	144.7	290	225.4	182.5
51	39.6	32.1	111	86.3	69.9	171	132.9	107.6	231	179.5	145.4	291	226.1	183.1
52	40.4	32.7	112	87.0	70.5	172	133.7	108.2	232	180.3	146.0	292	226.9	183.8
53	41.2	33.4	113	87.8	71.1	173	134.4	108.9	233	181.1	146.6	293	227.7	184.4
54	42.0	34.0	114	88.6	71.7	174	135.2	109.5	234	181.9	147.3	294	228.5	185.0
55	42.7	34.6	115	89.4	72.4	175	136.0	110.1	235	182.6	147.9	295	229.3	185.6
56	43.5	35.2	116	90.1	73.0	176	136.8	110.8	236	183.4	148.5	296	230.0	186.3
57	44.3	35.9	117	90.9	73.6	177	137.6	111.4	237	184.2	149.1	297	230.8	186.9
58	45.1	36.5	118	91.7	74.3	178	138.3	112.0	238	185.0	149.8	298	231.6	187.5
59	45.9	37.1	119	92.5	74.9	179	139.1	112.6	239	185.7	150.4	299	232.4	188.2
60	46.6	37.8	120	93.3	75.5	180	139.9	113.3	240	186.5	151.0	300	233.1	188.8
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 51 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 40 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.6	61	46.7	39.2	121	92.7	77.8	181	138.7	116.3	241	184.6	154.9
2	01.5	01.3	62	47.5	39.9	122	93.5	78.4	182	139.4	117.0	242	185.4	155.6
3	02.3	01.9	63	48.3	40.5	123	94.2	79.1	183	140.2	117.6	243	186.1	156.2
4	03.1	02.6	64	49.0	41.1	124	95.0	79.7	184	141.0	118.3	244	186.9	156.8
5	03.8	03.2	65	49.8	41.8	125	95.8	80.3	185	141.7	118.9	245	187.7	157.5
6	04.6	03.9	66	50.6	42.4	126	96.5	81.0	186	142.5	119.6	246	188.4	158.1
7	05.4	04.5	67	51.3	43.1	127	97.3	81.6	187	143.3	120.2	247	189.2	158.8
8	06.1	05.1	68	52.1	43.7	128	98.1	82.3	188	144.0	120.8	248	190.0	159.4
9	06.9	05.8	69	52.9	44.4	129	98.8	82.9	189	144.8	121.5	249	190.7	160.1
10	07.7	06.4	70	53.6	45.0	130	99.6	83.6	190	145.5	122.1	250	191.5	160.7
11	08.4	07.1	71	54.4	45.6	131	100.4	84.2	191	146.3	122.8	251	192.3	161.3
12	09.2	07.7	72	55.2	46.3	132	101.1	84.8	192	147.1	123.4	252	193.0	162.0
13	10.0	08.4	73	55.9	46.9	133	101.9	85.5	193	147.8	124.1	253	193.8	162.6
14	10.7	09.0	74	56.7	47.6	134	102.6	86.1	194	148.6	124.7	254	194.6	163.3
15	11.5	09.6	75	57.5	48.2	135	103.4	86.8	195	149.4	125.3	255	195.3	163.9
16	12.3	10.3	76	58.2	48.9	136	104.2	87.4	196	150.1	126.0	256	196.1	164.6
17	13.0	10.9	77	59.0	49.5	137	104.9	88.1	197	150.9	126.6	257	196.9	165.2
18	13.8	11.6	78	59.8	50.1	138	105.7	88.7	198	151.7	127.3	258	197.6	165.8
19	14.6	12.2	79	60.5	50.8	139	106.5	89.3	199	152.4	127.9	259	198.4	166.5
20	15.3	12.9	80	61.3	51.4	140	107.2	90.0	200	153.2	128.6	260	199.2	167.1
21	16.1	13.5	81	62.0	52.1	141	108.0	90.6	201	154.0	129.2	261	199.9	167.8
22	16.9	14.1	82	62.8	52.7	142	108.8	91.3	202	154.7	129.8	262	200.7	168.4
23	17.6	14.8	83	63.6	53.4	143	109.5	91.9	203	155.5	130.5	263	201.5	169.1
24	18.4	15.4	84	64.3	54.0	144	110.3	92.6	204	156.3	131.1	264	202.2	169.7
25	19.2	16.1	85	65.1	54.6	145	111.1	93.2	205	157.0	131.8	265	203.0	170.3
26	19.9	16.7	86	65.9	55.3	146	111.8	93.8	206	157.8	132.4	266	203.8	171.0
27	20.7	17.4	87	66.6	55.9	147	112.6	94.5	207	158.6	133.1	267	204.5	171.6
28	21.4	18.0	88	67.4	56.6	148	113.4	95.1	208	159.3	133.7	268	205.3	172.3
29	22.2	18.6	89	68.2	57.2	149	114.1	95.8	209	160.1	134.3	269	206.1	172.9
30	23.0	19.3	90	68.9	57.9	150	114.9	96.4	210	160.9	135.0	270	206.8	173.6
31	23.7	19.9	91	69.7	58.5	151	115.7	97.1	211	161.6	135.6	271	207.6	174.2
32	24.5	20.6	92	70.5	59.1	152	116.4	97.7	212	162.4	136.3	272	208.4	174.8
33	25.3	21.2	93	71.2	59.8	153	117.2	98.3	213	163.2	136.9	273	209.1	175.5
34	26.0	21.9	94	72.0	60.4	154	118.0	99.0	214	163.9	137.6	274	209.9	176.1
35	26.8	22.5	95	72.8	61.1	155	118.7	99.6	215	164.7	138.2	275	210.7	176.8
36	27.6	23.1	96	73.5	61.7	156	119.5	100.3	216	165.5	138.8	276	211.4	177.4
37	28.3	23.8	97	74.3	72.4	157	120.3	100.9	217	166.2	139.5	277	212.2	178.1
38	29.1	24.4	98	75.1	63.0	158	121.0	101.6	218	167.0	140.1	278	213.0	178.7
39	29.9	25.1	99	75.8	63.6	159	121.8	102.2	219	167.8	140.8	279	213.7	179.3
40	30.6	25.7	100	76.6	64.3	160	122.6	102.8	220	168.5	141.4	280	214.5	180.0
41	31.4	26.4	101	77.4	64.9	161	123.3	103.5	221	169.3	142.1	281	215.3	180.6
42	32.2	27.0	102	78.1	65.6	162	124.1	104.1	222	170.1	142.7	282	216.0	181.3
43	32.9	27.6	103	78.9	66.2	163	124.9	104.8	223	170.8	143.3	283	216.8	181.9
44	33.7	28.3	104	79.7	66.8	164	125.6	105.4	224	171.6	144.0	284	217.6	182.6
45	34.5	28.9	105	80.4	67.5	165	126.4	106.1	225	172.4	144.6	285	218.3	183.2
46	35.2	29.6	106	81.2	68.1	166	127.2	106.7	226	173.1	145.3	286	219.1	183.8
47	36.0	30.2	107	82.0	68.8	167	127.9	107.3	227	173.9	145.9	287	219.9	184.5
48	36.8	30.9	108	82.7	69.4	168	128.7	108.0	228	174.7	146.6	288	220.6	185.1
49	37.5	31.5	109	83.5	70.1	169	129.5	108.6	229	175.4	147.2	289	221.4	185.8
50	38.3	32.1	110	84.3	70.7	170	130.2	109.3	230	176.2	147.8	290	222.2	186.4
51	39.1	32.8	111	85.0	71.3	171	131.0	109.9	231	177.0	148.5	291	222.9	187.1
52	39.8	33.4	112	85.8	72.0	172	131.8	110.6	232	177.7	149.1	292	223.7	187.7
53	40.6	34.1	113	86.6	72.6	173	132.5	111.2	233	178.5	149.8	293	224.5	188.3
54	41.4	34.7	114	87.3	73.3	174	133.3	111.8	234	179.3	150.4	294	225.2	189.0
55	42.1	35.4	115	88.1	73.9	175	134.1	112.5	235	180.0	151.1	295	226.0	189.6
56	42.9	36.0	116	88.9	74.6	176	134.8	113.1	236	180.8	151.7	296	226.7	190.3
57	43.7	36.6	117	89.6	75.2	177	135.6	113.8	237	181.6	152.3	297	227.5	190.9
58	44.4	37.3	118	90.4	75.8	178	136.4	114.4	238	182.3	153.0	298	228.3	191.6
59	45.2	37.9	119	91.2	76.5	179	137.1	115.1	239	183.1	153.6	299	229.0	192.2
60	46.0	38.6	120	91.9	77.1	180	137.9	115.7	240	183.9	154.3	300	229.8	192.8
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 50 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 41 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.8	00.7	61	46.0	40.0	121	91.3	79.4	181	136.6	118.7	241	181.9	158.1
2	01 5	01.3	62	46.8	40.7	122	92.1	80.0	182	137.4	119.4	242	182.6	158.8
3	02.3	02.0	63	47.5	41.3	123	92 8	80.7	183	138.1	120.1	243	183.4	159.4
4	03.0	02.6	64	48.3	42.0	124	93.6	81.4	184	138.9	120.7	244	184.1	160.1
5	03.8	03.3	65	49.1	42.6	125	94.3	82.0	185	139.6	121.4	245	184.9	160 7
6	04.5	03.9	66	49.8	43.3	126	95.1	82.7	186	140.4	122.0	246	185.7	161.4
7	05.3	04.6	67	50.6	44.0	127	95.8	83.3	187	141.1	122.7	247	186.4	162.0
8	06.0	05.2	68	51.3	44.6	128	96.6	84.0	188	141.9	123.3	248	187.2	162.7
9	06.8	05.9	69	52.1	45.3	129	97.4	84.6	189	142.6	124.0	249	187.9	163.4
10	07.5	06.6	70	52.8	45.9	130	98.1	85.3	190	143.4	124.7	250	188.7	164.0
11	08.3	07.2	71	53.6	46.6	131	98 9	85.9	191	144.1	125 3	251	189.4	164.7
12	09.1	07.9	72	54.3	47.2	132	99.6	86.6	192	144.9	126.0	252	190.2	165.3
13	09.8	08.5	73	55.1	47.9	133	100.4	87.3	193	145.7	126.6	253	190.9	166.0
14	10.6	09.2	74	55.8	48.5	134	101.1	87.9	194	146.4	127.3	254	191.7	166.6
15	13.3	09.8	75	56.6	49.2	135	101.9	88.6	195	147.2	127.9	255	192 5	167.3
16	12.1	10 5	76	57.4	49.9	136	102.6	89.2	196	147.9	128.6	256	193.2	168.0
17	12.8	11.2	77	58.1	0.5	137	103.4	89.9	197	148.7	129 2	257	194.0	168.6
18	13.6	11.8	78	58.9	51.2	138	104.1	90.5	198	149.4	129.9	258	194.7	169.3
19	14.3	12.5	79	59.6	51.8	139	104.9	91.2	199	150.2	130.6	259	195.5	169 9
20	15.1	13.1	80	60.4	52.5	140	105.7	91.8	200	150 9	131.2	260	196.2	170 6
21	15.8	13.8	81	61.1	53.1	141	106.4	92.5	201	151.7	131.9	261	197.0	171.2
22	16 6	14.4	82	61.9	53.8	142	107.2	93.2	202	152.5	132.5	262	197.7	171.9
23	17.4	15.1	83	62.6	54.5	143	107.9	93.8	203	153.2	133.2	263	198 5	172 5
24	18 1	15.7	84	63 4	55.1	144	108.7	94.5	204	154.0	133.8	264	199.2	173.2
25	18.9	16.4	85	64.2	55.8	145	109.4	95.1	205	154.7	134.5	265	200.0	173.9
26	19.6	17.1	86	64.9	56.4	146	110 2	95.8	206	155.5	135.1	266	200.8	174.5
27	20.4	17.7	87	65.7	57.1	147	110.9	96.4	207	156.2	135.8	267	201.5	175.2
28	21.1	18.4	88	66.4	57.7	148	111.7	97.1	208	157.0	136.5	268	202.3	175 8
29	21.9	19.0	89	67.2	58.4	149	112 5	97.8	209	157.7	137.1	269	203.0	176.5
30	22.6	19.7	90	67.9	59.0	150	113.2	98.4	210	158.5	137.8	270	203.8	177.1
31	23.4	20.3	91	68.7	59.7	151	114.0	99.1	211	159.2	138.4	271	204.5	177.8
32	24.2	21.0	92	69.4	60.4	152	114.7	99.7	212	160.0	139.1	272	205.3	178.4
33	24.9	21.6	93	70.2	61.0	153	115.5	100.4	213	160.8	139.7	273	206 0	179.1
34	25.7	22.3	94	70.9	61.7	154	116 2	101.0	214	161 5	140.4	274	206.8	179.8
35	26.4	23.0	95	71.7	62.3	155	117.0	101.7	215	162.3	141.1	275	207.5	180.4
36	27.2	23.6	96	72.5	63.0	156	117.7	102.3	216	163.0	141.7	276	208.3	181.1
37	27.9	24.3	97	73.2	63.6	157	118.5	103 0	217	163.8	142.4	277	209.1	181.7
38	28.7	24.9	98	74.0	64.3	158	119.2	103.7	218	164.5	143.0	278	209.8	182.4
39	29.4	25.6	99	74.7	64.9	159	120.0	104.3	219	165.3	143.7	279	210.6	183.0
40	30.2	26.2	100	75.5	65.6	160	120.8	105.0	220	166.0	144.3	280	211.3	183.7
41	30.9	26.9	101	76.2	66.3	161	121.5	105.6	221	166.8	145.0	281	212.1	184.4
42	31.7	27.6	102	77.0	66.9	162	122.3	106.3	222	167 5	145.6	282	212.8	185.0
43	32.5	28 2	103	77.7	67.6	163	123.0	106.9	223	168.3	146.3	283	213.6	185.7
44	33.2	28.9	104	78.5	68.2	164	123.8	107.6	224	169.1	147.0	284	214.3	186.3
45	34.0	29 5	105	79.2	68.9	165	124.5	108.2	225	169.8	147.6	285	215.1	187.0
46	34.7	30.2	106	80.0	69.5	166	125.3	108 9	226	170.6	148.3	286	215.8	187.6
47	35.5	30.8	107	80.8	70.2	167	126 0	109.6	227	171.3	148.9	287	216.6	188.3
48	36.2	31.5	108	81.5	70.9	168	126.8	110.2	228	172.1	149.6	288	217.4	188.9
49	37.0	32.1	109	82.3	71.5	169	127.5	110.9	229	172.8	150.2	289	218.1	189.6
50	37.7	32.8	110	83.0	72.2	170	128.3	111.5	230	173.6	150.9	290	218.9	190.3
51	38.5	33 5	111	83.8	72.8	171	129.1	112.2	231	174.3	151.5	291	219.6	190.9
52	39.2	34.1	112	84.5	73.5	172	129.8	112.8	232	175.1	152.2	292	220 4	191.6
53	40.0	34.8	113	85.3	74.1	173	130.6	113.5	233	175.8	152.9	293	221.1	192.2
54	40.8	35.4	114	86.0	74.8	174	131.3	114.2	234	176.6	153.5	294	221.9	192.9
55	41.5	36.1	115	86.8	75.4	175	132.1	114.8	235	177.4	154.2	295	222.6	193.5
56	42.3	36.7	116	87.5	76.1	176	132.8	115.5	236	178.1	154.8	296	223.4	194 2
57	43.0	37.4	117	88.3	76.8	177	133.6	116.1	237	178.9	155.5	297	224.1	194 8
58	43.8	38.1	118	89 1	77.4	178	134.3	116.8	238	179.6	156.1	298	224 9	195 5
59	44.5	38.7	119	89 8	78 1	179	135.1	117.4	239	180.4	156.8	299	225.7	196 2
60	45.3	39 4	120	90.6	78.7	180	135.8	118.1	240	181.1	157.5	300	226.4	196.8
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 49 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 42 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.7	00.7	61	45.3	40.8	121	89.9	81.0	181	134.5	121.1	241	179.1	161.3
2	01.5	01.3	62	46.1	41.5	122	90.7	81.6	182	135.3	121.8	242	179.8	161.9
3	02.2	02.0	63	46.8	42.2	123	91.4	82.3	183	136.0	122.5	243	180.6	162.6
4	03.0	02.7	64	47.6	42.8	124	92.1	83.0	184	136.7	123.1	244	181.3	163.3
5	03.7	03.3	65	48.3	43.5	125	92.9	83.6	185	137.5	123.8	245	182.1	163.9
6	04.5	04.0	66	49.0	44.2	126	93.6	84.3	186	138.2	124.5	246	182.8	164.6
7	05.2	04.7	67	49.8	44.8	127	94.4	85.0	187	139.0	125.1	247	183.6	165.3
8	05.9	05.4	68	50.5	45.5	128	95.1	85.6	188	139.7	125.8	248	184.3	165.9
9	06.7	06.0	69	51.3	46.2	129	95.9	86.3	189	140.5	126.5	249	185.0	166.6
10	07.4	06.7	70	52.0	46.8	130	96.6	87.0	190	141.2	127.1	250	185.8	167.3
11	08.2	07.4	71	52.8	47.5	131	97.4	87.7	191	141.9	127.8	251	186.5	168.0
12	08.9	08.0	72	53.5	48.2	132	98.1	88.3	192	142.7	128.5	252	187.3	168.6
13	09.7	08.7	73	54.2	48.8	133	98.8	89.0	193	143.4	129.1	253	188.0	169.3
14	10.4	09.4	74	55.0	49.5	134	99.6	89.7	194	144.2	129.8	254	188.8	170.0
15	11.1	10.0	75	55.7	50.2	135	100.3	90.3	195	144.9	130.5	255	189.5	170.6
16	11.9	10.7	76	56.5	50.9	136	101.1	91.0	196	145.7	131.1	256	190.2	171.3
17	12.6	11.4	77	57.2	51.5	137	101.8	91.7	197	146.4	131.8	257	191.0	172.0
18	13.4	12.0	78	58.0	52.2	138	102.6	92.3	198	147.1	132.5	258	191.7	172.6
19	14.1	12.7	79	58.7	52.9	139	103.3	93.0	199	147.9	133.2	259	192.5	173.3
20	14.9	13.4	80	59.5	53.5	140	104.0	93.7	200	148.6	133.8	260	193.2	174.0
21	15.6	14.1	81	60.2	54.2	141	104.8	94.3	201	149.4	134.5	261	194.0	174.6
22	16.3	14.7	82	60.9	54.9	142	105.5	95.0	202	150.1	135.2	262	194.7	175.3
23	17.1	15.4	83	61.7	55.5	143	106.3	95.7	203	150.9	135.8	263	195.4	176.0
24	17.8	16.1	84	62.4	56.2	144	107.0	96.4	204	151.6	136.5	264	196.2	176.7
25	18.6	16.7	85	63.2	56.9	145	107.8	97.0	205	152.3	137.2	265	196.9	177.3
26	19.3	17.4	86	63.9	57.5	146	108.5	97.7	206	153.1	137.8	266	197.7	178.0
27	20.1	18.1	87	64.7	58.2	147	109.2	98.4	207	153.8	138.5	267	198.4	178.7
28	20.8	18.7	88	65.4	58.9	148	110.0	99.0	208	154.6	139.2	268	199.2	179.3
29	21.6	19.4	89	66.1	59.6	149	110.7	99.7	209	155.3	139.8	269	199.9	180.0
30	22.3	20.1	90	66.9	60.2	150	111.5	100.4	210	156.1	140.5	270	200.6	180.7
31	23.0	20.7	91	67.6	60.9	151	112.2	101.0	211	156.8	141.2	271	201.4	181.3
32	23.8	21.4	92	68.4	61.6	152	113.0	101.7	212	157.5	141.9	272	202.1	182.0
33	24.5	22.1	93	69.1	62.2	153	113.7	102.4	213	158.3	142.5	273	202.9	182.7
34	25.3	22.8	94	69.9	62.9	154	114.4	103.0	214	159.0	143.2	274	203.6	183.3
35	26.0	23.4	95	70.6	63.6	155	115.2	103.7	215	159.8	143.9	275	204.4	184.0
36	26.8	24.1	96	71.3	64.2	156	115.9	104.4	216	160.5	144.5	276	205.1	184.7
37	27.5	24.8	97	72.1	64.9	157	116.7	105.1	217	161.3	145.2	277	205.9	185.3
38	28.2	25.4	98	72.8	65.6	158	117.4	105.7	218	162.0	145.9	278	206.6	186.0
39	29.0	26.1	99	73.6	66.2	159	118.2	106.4	219	162.7	146.5	279	207.3	186.7
40	29.7	26.8	100	74.3	66.9	160	118.9	107.1	220	163.5	147.2	280	208.1	187.4
41	30.5	27.4	101	75.1	67.6	161	119.6	107.7	221	164.2	147.9	281	208.8	188.0
42	31.2	28.1	102	75.8	68.3	162	120.4	108.4	222	165.0	148.5	282	209.6	188.7
43	32.0	28.8	103	76.5	68.9	163	121.1	109.1	223	165.7	149.2	283	210.3	189.4
44	32.7	29.4	104	77.3	69.6	164	121.9	109.7	224	166.5	149.9	284	211.1	190.0
45	33.4	30.1	105	78.0	70.3	165	122.6	110.4	225	167.2	150.6	285	211.8	190.7
46	34.2	30.8	106	78.8	70.9	166	123.4	111.1	226	168.0	151.2	286	212.5	191.4
47	34.9	31.4	107	79.5	71.6	167	124.1	111.7	227	168.7	151.9	287	213.3	192.0
48	35.7	32.1	108	80.3	72.3	168	124.8	112.4	228	169.4	152.6	288	214.0	192.7
49	36.4	32.8	109	81.0	72.9	169	125.6	113.1	229	170.2	153.2	289	214.8	193.4
50	37.2	33.5	110	81.7	73.6	170	126.3	113.8	230	170.9	153.9	290	215.5	194.0
51	37.9	34.1	111	82.5	74.3	171	127.1	114.4	231	171.7	154.6	291	216.3	194.7
52	38.6	34.8	112	83.2	74.9	172	127.8	115.1	232	172.4	155.2	292	217.0	195.4
53	39.4	35.5	113	84.0	75.6	173	128.6	115.8	233	173.2	155.9	293	217.7	196.1
54	40.1	36.1	114	84.7	76.3	174	129.3	116.4	234	173.9	156.6	294	218.5	196.7
55	40.9	36.8	115	85.5	77.0	175	130.1	117.1	235	174.6	157.2	295	219.2	197.4
56	41.6	37.5	116	86.2	77.6	176	130.8	117.8	236	175.4	157.9	296	220.0	198.1
57	42.4	38.1	117	86.9	78.3	177	131.5	118.4	237	176.1	158.6	297	220.7	198.7
58	43.1	38.8	118	87.7	79.0	178	132.3	119.1	238	176.9	159.3	298	221.5	199.4
59	43.8	39.5	119	88.4	79.6	179	133.0	119.8	239	177.6	159.9	299	222.2	200.1
60	44.6	40.1	120	89.2	80.3	180	133.8	120.4	240	178.4	160.6	300	222.9	200.7
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 48 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 43 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.7	00.7	61	44.6	41.6	121	88.5	82.5	181	132.4	123.4	241	176.3	164.4
2	01.5	01.4	62	45.3	42.3	122	89.2	83.2	182	133.1	124.1	242	177.0	165.0
3	02.2	02.0	63	46.1	43.0	123	90.0	83.9	183	133.8	124.8	243	177.7	165.7
4	02.9	02.7	64	46.8	43.6	124	90.7	84.6	184	134.6	125.5	244	178.5	166.4
5	03.7	03.4	65	47.5	44.3	125	91.4	85.2	185	135.3	126.2	245	179.2	167.1
6	04.4	04.1	66	48.3	45.0	126	92.2	85.9	186	136.0	126.9	246	179.9	167.8
7	05.1	04.8	67	49.0	45.7	127	92.9	86.6	187	136.8	127.5	247	180.6	168.5
8	05.9	05.5	68	49.7	46.4	128	93.6	87.3	188	137.5	128.2	248	181.4	169.1
9	06.6	06.1	69	50.5	47.1	129	94.3	88.0	189	138.2	128.9	249	182.1	169.8
10	07.3	06.8	70	51.2	47.7	130	95.1	88.7	190	139.0	129.6	250	182.8	170.5
11	08.0	07.5	71	51.9	48.4	131	95.8	89.3	191	139.7	130.3	251	183.6	171.2
12	08.8	08.2	72	52.7	49.1	132	96.5	90.0	192	140.4	130.9	252	184.3	171.9
13	09.5	08.9	73	53.4	49.8	133	97.3	90.7	193	141.2	131.6	253	185.0	172.5
14	10.2	09.5	74	54.1	50.5	134	98.0	91.4	194	141.9	132.3	254	185.8	173.2
15	11.0	10.2	75	54.9	51.1	135	98.7	92.1	195	142.6	133.0	255	186.5	173.9
16	11.7	10.9	76	55.6	51.8	136	99.5	92.8	196	143.3	133.7	256	187.2	174.6
17	12.4	11.6	77	56.3	52.5	137	100.2	93.4	197	144.1	134.4	257	188.0	175.3
18	13.2	12.3	78	57.0	53.2	138	100.9	94.1	198	144.8	135.0	258	188.7	176.0
19	13.9	13.0	79	57.8	53.9	139	101.7	94.8	199	145.5	135.7	259	189.4	176.6
20	14.6	13.6	80	58.5	54.6	140	102.4	95.5	200	146.3	136.4	260	190.2	177.3
21	15.4	14.3	81	59.2	55.2	141	103.1	96.2	201	147.0	137.1	261	190.9	178.0
22	16.1	15.0	82	60.0	55.9	142	103.9	96.8	202	147.7	137.8	262	191.6	178.7
23	16.8	15.7	83	60.7	56.6	143	104.6	97.5	203	148.5	138.4	263	192.3	179.4
24	17.6	16.4	84	61.4	57.3	144	105.3	98.2	204	149.2	139.1	264	193.1	180.0
25	18.3	17.0	85	62.2	58.0	145	106.0	98.9	205	149.9	139.8	265	193.8	180.7
26	19.0	17.7	86	62.9	58.7	146	106.8	99.6	206	150.7	140.5	266	194.5	181.4
27	19.7	18.4	87	63.6	59.3	147	107.5	100.3	207	151.4	141.2	267	195.3	182.1
28	20.5	19.1	88	64.4	60.0	148	108.2	100.9	208	152.1	141.9	268	196.0	182.8
29	21.2	19.8	89	65.1	60.7	149	109.0	101.6	209	152.9	142.5	269	196.7	183.5
30	21.9	20.5	90	65.8	61.4	150	109.7	102.3	210	153.6	143.2	270	197.5	184.1
31	22.7	21.1	91	66.6	62.1	151	110.4	103.0	211	154.3	143.9	271	198.2	184.8
32	23.4	21.8	92	67.3	62.7	152	111.2	103.7	212	155.0	144.6	272	198.9	185.5
33	24.1	22.5	93	68.0	63.4	153	111.9	104.3	213	155.8	145.3	273	199.7	186.2
34	24.9	23.2	94	68.7	64.1	154	112.6	105.0	214	156.5	145.9	274	200.4	186.9
35	25.6	23.9	95	69.5	64.8	155	113.4	105.7	215	157.2	146.6	275	201.1	187.5
36	26.3	24.6	96	70.2	65.5	156	114.1	106.4	216	158.0	147.3	276	201.9	188.2
37	27.1	25.2	97	70.9	66.2	157	114.8	107.1	217	158.7	148.0	277	202.6	188.9
38	27.8	25.9	98	71.7	66.8	158	115.6	107.8	218	159.4	148.7	278	203.3	189.6
39	28.5	26.6	99	72.4	67.5	159	116.3	108.4	219	160.2	149.4	279	204.0	190.3
40	29.3	27.3	100	73.1	68.2	160	117.0	109.1	220	160.9	150.0	280	204.8	191.0
41	30.0	28.0	101	73.9	68.9	161	117.7	109.8	221	161.6	150.7	281	205.5	191.6
42	30.7	28.6	102	74.6	69.6	162	118.5	110.5	222	162.4	151.4	282	206.2	192.3
43	31.4	29.3	103	75.3	70.2	163	119.2	111.2	223	163.1	152.1	283	207.0	193.0
44	32.2	30.0	104	76.1	70.9	164	119.9	111.8	224	163.8	152.8	284	207.7	193.7
45	32.9	30.7	105	76.8	71.6	165	120.7	112.5	225	164.6	153.4	285	208.4	194.4
46	33.6	31.4	106	77.5	72.3	166	121.4	113.2	226	165.3	154.1	286	209.2	195.1
47	34.4	32.1	107	78.3	73.0	167	122.1	113.9	227	166.0	154.8	287	209.9	195.7
48	35.1	32.7	108	79.0	73.7	168	122.9	114.6	228	166.7	155.5	288	210.6	196.4
49	35.8	33.4	109	79.7	74.3	169	123.6	115.3	229	167.5	156.2	289	211.4	197.1
50	36.6	34.1	110	80.4	75.0	170	124.3	115.9	230	168.2	156.9	290	212.1	197.8
51	37.3	34.8	111	81.2	75.7	171	125.1	116.6	231	168.9	157.5	291	212.8	198.5
52	38.0	35.5	112	81.9	76.4	172	125.8	117.3	232	169.7	158.2	292	213.6	199.1
53	38.8	36.1	113	82.6	77.1	173	126.5	118.0	233	170.4	158.9	293	214.3	199.8
54	39.5	36.8	114	83.4	77.7	174	127.3	118.7	234	171.1	159.6	294	215.0	200.5
55	40.2	37.5	115	84.1	78.4	175	128.0	119.3	235	171.9	160.3	295	215.7	201.2
56	41.0	38.2	116	84.8	79.1	176	128.7	120.0	236	172.6	161.0	296	216.5	201.9
57	41.7	38.9	117	85.6	79.8	177	129.4	120.7	237	173.3	161.6	297	217.2	202.6
58	42.4	39.6	118	86.3	80.5	178	130.2	121.4	238	174.1	162.3	298	217.9	203.2
59	43.1	40.2	119	87.0	81.2	179	130.9	122.1	239	174.8	163.0	299	218.7	203.9
60	43.9	40.9	120	87.8	81.8	180	131.6	122.8	240	175.5	163.7	300	219.4	204.6
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 47 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 44 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.7	00.7	61	43.9	42.4	121	87.0	84.1	181	130.2	125.7	241	173.4	167.4
2	01.4	01.4	62	44.6	43.1	122	87.8	84.7	182	130.9	126.4	242	174.1	168.1
3	02.2	02.1	63	45.3	43.8	123	88.5	85.4	183	131.6	127 1	243	174.8	168.8
4	02.9	02.8	64	46.0	44.5	124	89.2	86.1	184	132.4	127.8	244	175.5	169.5
5	03.6	03.5	65	46.8	45.2	125	89.9	86.8	185	133.1	128.5	245	176.2	170.2
6	04.3	04.2	66	47.5	45.8	126	90.6	87.5	186	133.8	129.2	246	177.0	170.9
7	05.0	04.9	67	48.2	46.5	127	91.4	88.2	187	134.5	129.9	247	177.7	171.6
8	05.8	05.6	68	48.9	47.2	128	92.1	88.9	188	135.2	130.6	248	178.4	172.3
9	06.5	06.3	69	49.6	47.9	129	92.8	89.6	189	136.0	131.3	249	179.1	173.0
10	07.2	06.9	70	50.4	48.6	130	93.5	90.3	190	136.7	132.0	250	179.8	173.7
11	07.9	07.6	71	51.1	49.3	131	94.2	91.0	191	137.4	132.7	251	180.6	174.4
12	08.6	08.3	72	51.8	50.0	132	95.0	91.7	192	138.1	133.4	252	181.3	175.1
13	09.4	09.0	73	52.5	50.7	133	95 7	92.4	193	138.8	134.1	253	182.0	175.7
14	10.1	09.7	74	53.2	51.4	134	96.4	93.1	194	139.6	134.8	254	182.7	176.4
15	10.8	10.4	75	54.0	52.1	135	97.1	93.8	195	140.3	135.5	255	183.4	177.1
16	11.5	11.1	76	54.7	52.8	136	97.8	94.5	196	141.0	136.2	256	184.2	177.8
17	12.2	11.8	77	55.4	53.5	137	98.5	95.2	197	141.7	136.8	257	184.9	178.5
18	12.9	12.5	78	56.1	54.2	138	99.3	95.9	198	142.4	137.5	258	185.6	179.2
19	13.7	13.2	79	56.8	54.9	139	100.0	96.6	199	143.1	138.2	259	186.3	179.9
20	14.4	13.9	80	57.5	55.6	140	100.7	97.3	200	143.9	138.9	260	187.0	180.6
21	15.1	14.6	81	58.3	56.3	141	101.4	97.9	201	144.6	139.6	261	187.7	181.3
22	15.8	15.3	82	59.0	57.0	142	102.1	98 6	202	145.3	140.3	262	188.5	182.0
23	16.5	16.0	83	59.7	57.7	143	102.9	99.3	203	146.0	141.0	263	189.2	182.7
24	17.3	16.7	84	60.4	58.4	144	103.6	100.0	204	146.7	141.7	264	189.9	183.4
25	18.0	17.4	85	61.1	59.0	145	104.3	100.7	205	147.5	142 4	265	190.6	184.1
26	18.7	18.1	86	61.9	59.7	146	105.0	101.4	206	148.2	143.1	266	191.3	184.8
27	19.4	18.8	87	62.6	60.4	147	105.7	102.1	207	148.9	143.8	267	192.1	185.5
28	20.1	19.5	88	63.3	61.1	148	106.5	102.8	208	149.6	144.5	268	192.8	186.2
29	20.9	20 1	89	64.0	61.8	149	107.2	103.5	209	150.3	145.2	269	193.5	186.9
30	21.6	20.8	90	64.7	62.5	150	107.9	104.2	210	151.1	145.9	270	194.2	187.6
31	22.3	21.5	91	65.5	63.2	151	108.6	104.9	211	151.8	146.6	271	194.9	188.3
32	23.0	22.2	92	66.2	63.9	152	109.3	105.6	212	152.5	147.3	272	195.7	188.9
33	23.7	22.9	93	66.9	64.6	153	110.1	106.3	213	153.2	148.0	273	196.4	189.6
34	24.5	23.6	94	67.6	65.3	154	110.8	107.0	214	153.9	148.7	274	197.1	190.3
35	25.2	24.3	95	68.3	66.0	155	111.5	107.7	215	154.7	149.4	275	197.8	191.0
36	25.9	25.0	96	69.1	66.7	156	112.2	108.4	216	155.4	150.0	276	198.5	191.7
37	26.6	25.7	97	69.8	67.4	157	112.9	109.1	217	156.1	150.7	277	199.3	192.4
38	27.3	26.4	98	70.5	68.1	158	113.7	109.8	218	156.8	151.4	278	200.0	193.1
39	28.1	27.1	99	71.2	68.8	159	114.4	110.5	219	157.5	152.1	279	200.7	193 8
40	28.8	27.8	100	71.9	69.5	160	115.1	111 1	220	158.3	152.8	280	201.4	194.5
41	29.5	28.5	101	72.7	70.2	161	115.8	111.8	221	159.0	153.5	281	202.1	195.2
42	30.2	29.2	102	73.4	70.9	162	116.5	112.5	222	159.7	154.2	282	202.9	195.9
43	30.9	29.9	103	74.1	71.5	163	117.3	113.2	223	160.4	154.9	283	203.6	196.6
44	31.7	30.6	104	74.8	72.2	164	118.0	113.9	224	161.1	155.6	284	204.3	197.3
45	32.4	31.3	105	75.5	72.9	165	118.7	114.6	225	161.9	156.3	285	205.0	198.0
46	33.1	32.0	106	76.3	73.6	166	119.4	115.3	226	162.6	157.0	286	205.7	198.7
47	33.8	32.6	107	77.0	74.3	167	120.1	116.0	227	163.3	157.7	287	206.5	199.4
48	34.5	33.3	108	77.7	75.0	168	120.8	116.7	228	164.0	158.4	288	207.2	200.1
49	35.2	34.0	109	78.4	75.7	169	121.6	117.4	229	164.7	159.1	289	207.9	200.8
50	36.0	34.7	110	79.1	76.4	170	122.3	118.1	230	165.4	159.8	290	208.6	201.5
51	36.7	35.4	111	79.8	77.1	171	123.0	118.8	231	166.2	160.5	291	209.3	202.1
52	37.4	36.1	112	80.6	77.8	172	123.7	119.5	232	166.9	161.2	292	210.0	202.8
53	38.1	36.8	113	81.3	78.5	173	124.4	120.2	233	167.6	161.9	293	210.8	203.5
54	38.8	37.5	114	82.0	79.2	174	125.2	120.9	234	168.3	162.6	294	211.5	204.2
55	39.6	38.2	115	82.7	79.9	175	125.9	121.6	235	169.0	163.2	295	212.2	204.9
56	40.3	38.9	116	83.4	80.6	176	126.6	122.3	236	169.8	163.9	296	212.9	205.6
57	41.0	39.6	117	84.2	81.3	177	127.3	123.0	237	170.5	164.6	297	213.6	206.3
58	41.7	40 3	118	84.9	82.0	178	128.0	123.6	238	171.2	165.3	298	214.4	207.0
59	42.4	41.0	119	85.6	82.7	179	128.8	124.3	239	171.9	166.0	299	215.1	207.7
60	43 2	41.7	120	86.3	83.4	180	129 5	125.0	240	172.6	166.7	300	215.8	208.4
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 46 Degrees.

TABLE IV.

DIFFERENCE OF LATITUDE AND DEPARTURE FOR 45 DEGREES.

Dist.	Lat.	Dep	Dist.	Lat.	Dep	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.	Dist.	Lat.	Dep.
1	00.7	00.7	61	43.1	43.1	121	85.6	85.6	181	128.0	128.0	241	170.4	170.4
2	01.4	01.4	62	43.8	43.8	122	86.3	86.3	182	128.7	128.7	242	171.1	171.1
3	02.1	02.1	63	44.5	44.5	123	87.0	87.0	183	129.4	129.4	243	171.8	171.8
4	02.8	02.8	64	45.3	45.3	124	87.7	87.7	184	130.1	130.1	244	172.5	172.5
5	03.5	03.5	65	46.0	46.0	125	88.4	88.4	185	130.8	130.8	245	173.2	173.2
6	04.2	04.2	66	46.7	46.7	126	89.1	89.1	186	131.5	131.5	246	173.9	173.9
7	04.9	04.9	67	47.4	47.4	127	89.8	89.8	187	132.2	132.2	247	174.7	174.7
8	05.7	05.7	68	48.1	48.1	128	90.5	90.5	188	132.9	132.9	248	175.4	175.4
9	06.4	06.4	69	48.8	48.8	129	91.2	91.2	189	133.6	133.6	249	176.1	176.1
10	07.1	07.1	70	49.5	49.5	130	91.9	91.9	190	134.3	134.3	250	176.8	176.8
11	07.8	07.8	71	50.2	50.2	131	92.6	92.6	191	135.1	135.1	251	177.5	177.5
12	08.5	08.5	72	50.9	50.9	132	93.3	93.3	192	135.8	135.8	252	178.2	178.2
13	09.2	09.2	73	51.6	51.6	133	94.0	94.0	193	136.5	136.5	253	178.9	178.9
14	09.9	09.9	74	52.3	52.3	134	94.8	94.8	194	137.2	137.2	254	179.6	179.6
15	10.6	10.6	75	53.0	53.0	135	95.5	95.5	195	137.9	137.9	255	180.3	180.3
16	11.3	11.3	76	53.7	53.7	136	96.2	96.2	196	138.6	138.6	256	181.0	181.0
17	12.0	12.0	77	54.4	54.4	137	96.9	96.9	197	139.3	139.3	257	181.7	181.7
18	12.7	12.7	78	55.2	55.2	138	97.6	97.6	198	140.0	140.0	258	182.4	182.4
19	13.4	13.4	79	55.9	55.9	139	98.3	98.3	199	140.7	140.7	259	183.1	183.1
20	14.1	14.1	80	56.6	56.6	140	99.0	99.0	200	141.4	141.4	260	183.8	183.8
21	14.8	14.8	81	57.3	57.3	141	99.7	99.7	201	142.1	142.1	261	184.6	184.6
22	15.6	15.6	82	58.0	58.0	142	100.4	100.4	202	142.8	142.8	262	185.3	185.3
23	16.3	16.3	83	58.7	58.7	143	101.1	101.1	203	143.5	143.5	263	186.0	186.0
24	17.0	17.0	84	59.4	59.4	144	101.8	101.8	204	144.2	144.2	264	186.7	186.7
25	17.7	17.7	85	60.1	60.1	145	102.5	102.5	205	145.0	145.0	265	187.4	187.4
26	18.4	18.4	86	60.8	60.8	146	103.2	103.2	206	145.7	145.7	266	188.1	188.1
27	19.1	19.1	87	61.5	61.5	147	103.9	103.9	207	146.4	146.4	267	188.8	188.8
28	19.8	19.8	88	62.2	62.2	148	104.7	104.7	208	147.1	147.1	268	189.5	189.5
29	20.5	20.5	89	62.9	62.9	149	105.4	105.4	209	147.8	147.8	269	190.2	190.2
30	21.2	21.2	90	63.6	63.6	150	106.1	106.1	210	148.5	148.5	270	190.9	190.9
31	21.9	21.9	91	64.3	64.3	151	106.8	106.8	211	149.2	149.2	271	191.6	191.6
32	22.6	22.6	92	65.1	65.1	152	107.5	107.5	212	149.9	149.9	272	192.3	192.3
33	23.3	23.3	93	65.8	65.8	153	108.2	108.2	213	150.6	150.6	273	193.0	193.0
34	24.0	24.0	94	66.5	66.5	154	108.9	108.9	214	151.3	151.3	274	193.7	193.7
35	24.7	24.7	95	67.2	67.2	155	109.6	109.6	215	152.0	152.0	275	194.5	194.5
36	25.5	25.5	96	67.9	67.9	156	110.3	110.3	216	152.7	152.7	276	195.2	195.2
37	26.2	26.2	97	68.6	68.6	157	111.0	111.0	217	153.4	153.4	277	195.9	195.9
38	26.9	26.9	98	69.3	69.3	158	111.7	111.7	218	154.1	154.1	278	196.6	196.6
39	27.6	27.6	99	70.0	70.0	159	112.4	112.4	219	154.9	154.9	279	197.3	197.3
40	28.3	28.3	100	70.7	70.7	160	113.1	113.1	220	155.6	155.6	280	198.0	198.0
41	29.0	29.0	101	71.4	71.4	161	113.8	113.8	221	156.3	156.3	281	198.7	198.7
42	29.7	29.7	102	72.1	72.1	162	114.5	114.5	222	157.0	157.0	282	199.4	199.4
43	30.4	30.4	103	72.8	72.8	163	115.3	115.3	223	157.7	157.7	283	200.1	200.1
44	31.1	31.1	104	73.5	73.5	164	116.0	116.0	224	158.4	158.4	284	200.8	200.8
45	31.8	31.8	105	74.2	74.2	165	116.7	116.7	225	159.1	159.1	285	201.5	201.5
46	32.5	32.5	106	75.0	75.0	166	117.4	117.4	226	159.8	159.8	286	202.2	202.2
47	33.2	33.2	107	75.7	75.7	167	118.1	118.1	227	160.5	160.5	287	202.9	202.9
48	33.9	33.9	108	76.4	76.4	168	118.8	118.8	228	161.2	161.2	288	203.6	203.6
49	34.6	34.6	109	77.1	77.1	169	119.5	119.5	229	161.9	161.9	289	204.3	204.3
50	35.4	35.4	110	77.8	77.8	170	120.2	120.2	230	162.6	162.6	290	205.1	205.1
51	36.1	36.1	111	78.5	78.5	171	120.9	120.9	231	163.3	163.3	291	205.8	205.8
52	36.8	36.8	112	79.2	79.2	172	121.6	121.6	232	164.0	164.0	292	206.5	206.5
53	37.5	37.5	113	79.9	79.9	173	122.3	122.3	233	164.8	164.8	293	207.2	207.2
54	38.2	38.2	114	80.6	80.6	174	123.0	123.0	234	165.5	165.5	294	207.9	207.9
55	38.9	38.9	115	81.3	81.3	175	123.7	123.7	235	166.2	166.2	295	208.6	208.6
56	39.6	39.6	116	82.0	82.0	176	124.4	124.4	236	166.9	166.9	296	209.3	209.3
57	40.3	40.3	117	82.7	82.7	177	125.2	125.2	237	167.6	167.6	297	210.0	210.0
58	41.0	41.0	118	83.4	83.4	178	125.9	125.9	238	168.3	168.3	298	210.7	210.7
59	41.7	41.7	119	84.1	84.1	179	126.6	126.6	239	169.0	169.0	299	211.4	211.4
60	42.4	42.4	120	84.9	84.9	180	127.3	127.3	240	169.7	169.7	300	212.1	212.1
Dist.	Dep	Lat.	Dist.	Dep	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.	Dist.	Dep.	Lat.

For 45 Degrees.

TABLE V.

MERIDIONAL PARTS.

M.	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	M.
0	0	60	120	180	240	300	361	421	482	542	603	664	725	787	849	910	0
1	1	61	121	181	241	301	362	422	483	543	604	665	726	788	850	912	1
2	2	62	122	182	242	302	363	423	484	544	605	666	727	789	851	913	2
3	3	63	123	183	243	303	364	424	485	545	606	667	728	790	852	914	3
4	4	64	124	184	244	304	365	425	486	546	607	668	729	791	853	915	4
5	5	65	125	185	245	305	366	426	487	547	608	669	730	792	854	916	5
6	6	66	126	186	246	306	367	427	488	548	609	670	731	793	855	917	6
7	7	67	127	187	247	307	368	428	489	549	610	671	732	794	856	918	7
8	8	68	128	188	248	308	369	429	490	550	611	672	734	795	857	919	8
9	9	69	129	189	249	309	370	430	491	551	612	673	735	796	858	920	9
10	10	70	130	190	250	310	371	431	492	552	613	674	736	797	859	921	10
11	11	71	131	191	251	311	372	432	493	553	614	675	737	798	860	922	11
12	12	72	132	192	252	312	373	433	494	554	615	676	738	799	861	923	12
13	13	73	133	193	253	313	374	434	495	555	616	677	739	800	862	924	13
14	14	74	134	194	254	314	375	435	496	556	617	678	740	801	863	925	14
15	15	75	135	195	255	315	376	436	497	557	618	679	741	802	864	926	15
16	16	76	136	196	256	316	377	437	498	558	619	680	742	833	865	927	16
17	17	77	137	197	257	317	378	438	499	559	620	681	743	804	866	928	17
18	18	78	138	198	258	318	379	439	500	560	621	682	744	805	867	929	18
19	19	79	139	199	259	319	380	440	501	561	622	683	745	806	868	930	19
20	20	80	140	200	260	320	381	441	502	562	623	684	746	807	869	931	20
21	21	81	141	201	261	321	382	442	503	564	624	685	747	808	870	932	21
22	22	82	142	202	262	322	383	443	504	565	625	687	748	809	871	933	22
23	23	83	143	203	263	323	384	444	505	566	626	688	749	810	872	934	23
24	24	84	144	204	264	324	385	445	506	567	627	689	750	811	873	935	24
25	25	85	145	205	265	325	386	446	507	568	628	690	751	812	874	936	25
26	26	86	146	206	266	326	387	447	508	569	629	691	752	813	875	937	26
27	27	87	147	207	267	327	388	448	509	570	631	692	753	815	876	938	27
28	28	88	148	208	268	328	389	449	510	571	632	693	754	816	877	939	28
29	29	89	149	209	269	330	390	450	511	572	633	694	755	817	878	941	29
30	30	90	150	210	270	331	391	451	512	573	634	695	756	818	879	942	30
31	31	91	151	211	271	332	392	452	513	574	635	696	757	819	880	943	31
32	32	92	152	212	272	333	393	453	514	575	636	697	758	820	882	944	32
33	33	93	153	213	273	334	394	454	515	576	637	698	759	821	883	945	33
34	34	94	154	214	274	335	395	455	516	577	638	699	760	822	884	946	34
35	35	95	155	215	275	336	396	456	517	578	639	700	761	823	885	947	35
36	36	96	156	216	276	337	397	457	518	579	640	701	762	824	886	948	36
37	37	97	157	217	277	338	398	458	519	580	641	702	763	825	887	949	37
38	38	98	158	218	278	339	399	459	520	581	642	703	764	826	888	950	38
39	39	99	159	219	279	340	400	460	521	582	643	704	765	827	889	951	39
40	40	100	160	220	280	341	401	461	522	583	644	705	766	828	890	952	40
41	41	101	161	221	281	342	402	462	523	584	645	706	767	829	891	953	41
42	42	102	162	222	282	343	403	463	524	585	646	707	768	830	892	954	42
43	43	103	163	223	283	344	404	464	525	586	647	708	769	831	893	955	43
44	44	104	164	224	284	345	405	465	526	587	648	709	770	832	894	956	44
45	45	105	165	225	285	346	406	466	527	588	649	710	771	833	895	957	45
46	46	106	166	226	286	347	407	467	528	589	650	711	772	834	896	958	46
47	47	107	167	227	287	348	408	468	529	590	651	712	773	835	897	959	47
48	48	108	168	228	288	349	409	469	530	591	652	713	774	836	898	960	48
49	49	109	169	229	289	350	410	470	531	592	653	714	776	837	899	961	49
50	50	110	170	230	290	351	411	471	532	593	654	715	777	838	900	962	50
51	51	111	171	231	291	352	412	472	533	594	655	716	778	839	901	963	51
52	52	112	172	232	292	353	413	473	534	595	656	717	779	840	902	964	52
53	53	113	173	233	293	354	414	474	535	596	657	718	780	841	903	965	53
54	54	114	174	234	294	355	415	476	536	597	658	719	781	842	904	966	54
55	55	115	175	235	295	356	416	477	537	598	659	720	782	843	905	968	55
56	56	116	176	236	296	357	417	478	538	599	660	721	783	814	906	969	56
57	57	117	177	237	297	358	418	479	539	600	661	722	784	845	907	970	57
58	58	118	178	238	298	359	419	480	540	601	662	723	785	846	908	971	58
59	59	119	179	239	299	360	420	481	541	602	663	724	786	847	909	972	59
M.	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	M.

TABLE V.

MERIDIONAL PARTS.

M.	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	M.
0	973	1035	1098	1161	1225	1289	1354	1419	1484	1550	1616	0
1	974	1036	1099	1163	1226	1290	1355	1420	1485	1551	1618	1
2	975	1037	1100	1164	1227	1291	1356	1421	1486	1552	1619	2
3	976	1038	1101	1165	1228	1292	1357	1422	1487	1553	1620	3
4	977	1039	1102	1166	1229	1293	1358	1423	1488	1554	1621	4
5	978	1041	1103	1167	1230	1295	1359	1424	1490	1556	1622	5
6	979	1042	1105	1168	1232	1296	1360	1425	1491	1557	1623	6
7	980	1043	1106	1169	1233	1297	1361	1426	1492	1558	1624	7
8	981	1044	1107	1170	1234	1298	1362	1427	1493	1559	1625	8
9	982	1045	1108	1171	1235	1299	1363	1428	1494	1560	1626	9
10	983	1046	1109	1172	1236	1300	1364	1430	1495	1561	1628	10
11	984	1047	1110	1173	1237	1301	1366	1431	1496	1562	1629	11
12	985	1048	1111	1174	1238	1302	1367	1432	1497	1563	1630	12
13	986	1049	1112	1175	1239	1303	1368	1433	1498	1564	1631	13
14	987	1050	1113	1176	1240	1304	1369	1434	1499	1565	1632	14
15	988	1051	1114	1177	1241	1305	1370	1435	1500	1567	1633	15
16	989	1052	1115	1178	1242	1306	1371	1436	1502	1568	1634	16
17	990	1053	1116	1179	1243	1307	1372	1437	1503	1569	1635	17
18	991	1054	1117	1181	1244	1308	1373	1438	1504	1570	1637	18
19	993	1055	1118	1182	1245	1310	1374	1439	1505	1571	1638	19
20	994	1056	1119	1183	1246	1311	1375	1440	1506	1572	1639	20
21	995	1057	1120	1184	1248	1312	1376	1441	1507	1573	1640	21
22	996	1058	1121	1185	1249	1313	1377	1443	1508	1574	1641	22
23	997	1059	1122	1186	1250	1314	1379	1444	1509	1575	1642	23
24	998	1060	1123	1187	1251	1315	1380	1445	1510	1577	1643	24
25	999	1061	1125	1188	1252	1316	1381	1446	1511	1578	1644	25
26	1000	1063	1126	1189	1253	1317	1382	1447	1513	1579	1645	26
27	1001	1064	1127	1190	1254	1318	1383	1448	1514	1580	1647	27
28	1002	1065	1128	1191	1255	1319	1384	1449	1515	1581	1648	28
29	1003	1066	1129	1192	1256	1320	1385	1450	1516	1582	1649	29
30	1004	1067	1130	1193	1257	1321	1386	1451	1517	1583	1650	30
31	1005	1068	1131	1194	1258	1322	1387	1452	1518	1584	1651	31
32	1006	1069	1132	1195	1259	1324	1388	1453	1519	1585	1652	32
33	1007	1070	1133	1196	1260	1325	1389	1455	1520	1586	1653	33
34	1008	1071	1134	1198	1261	1326	1390	1456	1521	1588	1654	34
35	1009	1072	1135	1199	1262	1327	1392	1457	1522	1589	1656	35
36	1010	1073	1136	1200	1264	1328	1393	1458	1524	1590	1657	36
37	1011	1074	1137	1201	1265	1329	1394	1459	1525	1591	1658	37
38	1012	1075	1138	1202	1266	1330	1395	1460	1526	1592	1659	38
39	1013	1076	1139	1203	1267	1331	1396	1461	1527	1593	1660	39
40	1014	1077	1140	1204	1268	1332	1397	1462	1528	1594	1661	40
41	1015	1078	1141	1205	1269	1333	1398	1463	1529	1595	1662	41
42	1016	1079	1142	1206	1270	1334	1399	1464	1530	1596	1663	42
43	1018	1080	1144	1207	1271	1335	1400	1465	1531	1598	1664	43
44	1019	1081	1145	1208	1272	1336	1401	1467	1532	1599	1666	44
45	1020	1082	1146	1209	1273	1338	1402	1468	1533	1600	1667	45
46	1021	1084	1147	1210	1274	1339	1403	1469	1535	1601	1668	46
47	1022	1085	1148	1211	1275	1340	1405	1470	1536	1602	1669	47
48	1023	1086	1149	1212	1276	1341	1406	1471	1537	1603	1670	48
49	1024	1087	1150	1213	1277	1342	1407	1472	1538	1604	1671	49
50	1025	1088	1151	1215	1278	1343	1408	1473	1539	1605	1672	50
51	1026	1089	1152	1216	1280	1344	1409	1474	1540	1606	1673	51
52	1027	1090	1153	1217	1281	1345	1410	1475	1541	1608	1675	52
53	1028	1091	1154	1218	1282	1346	1411	1476	1542	1609	1676	53
54	1029	1092	1155	1219	1283	1347	1412	1477	1543	1610	1677	54
55	1030	1093	1156	1220	1284	1348	1413	1479	1544	1611	1678	55
56	1031	1094	1157	1221	1285	1349	1414	1480	1546	1612	1679	56
57	1032	1095	1158	1222	1286	1350	1415	1481	1547	1613	1680	57
58	1033	1096	1159	1223	1287	1352	1416	1482	1548	1614	1681	58
59	1034	1097	1160	1224	1288	1353	1418	1483	1549	1615	1682	59
M.	16°	17°	18°	19°	20°	21°	22	23°	24°	25°	26°	M.

TABLE V.

MERIDIONAL PARTS.

M.	27°	28°	29°	30°	31°	32°	33°	34°	35°	36°	37°	M.
0	1684	1751	1819	1888	1958	2028	2100	2171	2244	2318	2393	0
1	1685	1752	1821	1890	1959	2030	2101	2173	2246	2319	2394	1
2	1686	1753	1822	1891	1960	2031	2102	2174	2247	2320	2395	2
3	1687	1755	1823	1892	1962	2032	2103	2175	2248	2322	2396	3
4	1688	1756	1824	1893	1963	2033	2104	2176	2249	2323	2398	4
5	1689	1757	1825	1894	1964	2034	2105	2178	2250	2324	2399	5
6	1690	1758	1826	1895	1965	2035	2107	2179	2252	2325	2400	6
7	1691	1759	1827	1896	1966	2037	2108	2180	2253	2327	2401	7
8	1693	1760	1829	1898	1967	2038	2109	2181	2254	2328	2403	8
9	1694	1761	1830	1899	1969	2039	2110	2182	2255	2329	2404	9
10	1695	1762	1831	1900	1970	2040	2111	2184	2257	2330	2405	10
11	1696	1764	1832	1901	1971	2041	2113	2185	2258	2332	2406	11
12	1697	1765	1833	1902	1972	2043	2114	2186	2259	2333	2408	12
13	1698	1766	1834	1903	1973	2044	2115	2187	2260	2334	2409	13
14	1699	1767	1835	1905	1974	2045	2116	2188	2261	2335	2410	14
15	1700	1768	1837	1906	1976	2046	2117	2190	2263	2337	2411	15
16	1701	1769	1838	1907	1977	2047	2119	2191	2264	2338	2413	16
17	1703	1770	1839	1908	1978	2048	2120	2192	2265	2339	2414	17
18	1704	1772	1840	1909	1979	2050	2121	2193	2266	2340	2415	18
19	1705	1773	1841	1910	1980	2051	2122	2194	2268	2342	2416	19
20	1706	1774	1842	1912	1981	2052	2123	2196	2269	2343	2418	20
21	1707	1775	1843	1913	1983	2053	2125	2197	2270	2344	2419	21
22	1708	1776	1845	1914	1984	2054	2126	2198	2271	2345	2420	22
23	1709	1777	1846	1915	1985	2056	2127	2199	2272	2346	2422	23
24	1711	1778	1847	1916	1986	2057	2128	2200	2274	2348	2423	24
25	1712	1780	1848	1917	1987	2058	2129	2202	2275	2349	2424	25
26	1713	1781	1849	1918	1988	2059	2131	2203	2276	2350	2425	26
27	1714	1782	1850	1920	1990	2060	2132	2204	2277	2351	2427	27
28	1715	1783	1852	1921	1991	2061	2133	2205	2279	2353	2428	28
29	1716	1784	1853	1922	1992	2063	2134	2207	2280	2354	2429	29
30	1717	1785	1854	1923	1993	2064	2135	2208	2281	2355	2430	30
31	1718	1786	1855	1924	1994	2065	2137	2209	2282	2356	2432	31
32	1720	1787	1856	1925	1995	2066	2138	2210	2283	2358	2433	32
33	1721	1789	1857	1927	1997	2067	2139	2211	2285	2359	2434	33
34	1722	1790	1858	1928	1998	2069	2140	2213	2286	2360	2435	34
35	1723	1791	1860	1929	1999	2070	2141	2214	2287	2361	2437	35
36	1724	1792	1861	1930	2000	2071	2143	2215	2288	2363	2438	36
37	1725	1793	1862	1931	2001	2072	2144	2216	2290	2364	2439	37
38	1726	1794	1863	1932	2002	2073	2145	2217	2291	2365	2440	38
39	1727	1795	1864	1934	2004	2075	2146	2219	2292	2366	2442	39
40	1729	1797	1865	1935	2005	2076	2147	2220	2293	2368	2443	40
41	1730	1798	1866	1936	2006	2077	2149	2221	2295	2369	2444	41
42	1731	1799	1868	1937	2007	2078	2150	2222	2296	2370	2445	42
43	1732	1800	1869	1938	2008	2079	2151	2224	2297	2371	2447	43
44	1733	1801	1870	1939	2010	2080	2152	2225	2298	2373	2448	44
45	1734	1802	1871	1941	2011	2082	2153	2226	2299	2374	2449	45
46	1735	1803	1872	1942	2012	2083	2155	2227	2301	2375	2451	46
47	1736	1805	1873	1943	2013	2084	2156	2228	2302	2376	2452	47
48	1738	1806	1875	1944	2014	2085	2157	2230	2303	2378	2453	48
49	1739	1807	1876	1945	2015	2086	2158	2231	2304	2379	2454	49
50	1740	1808	1877	1946	2017	2088	2159	2232	2306	2380	2456	50
51	1741	1809	1878	1948	2018	2089	2161	2233	2307	2381	2457	51
52	1742	1810	1879	1949	2019	2090	2162	2235	2308	2383	2458	52
53	1743	1811	1880	1950	2020	2091	2163	2236	2309	2384	2459	53
54	1744	1813	1881	1951	2021	2092	2164	2237	2311	2385	2461	54
55	1746	1814	1883	1952	2022	2094	2165	2238	2312	2386	2462	55
56	1747	1815	1884	1953	2024	2095	2167	2239	2313	2388	2463	56
57	1748	1816	1885	1955	2025	2096	2168	2241	2314	2389	2464	57
58	1749	1817	1886	1956	2026	2097	2169	2242	2316	2390	2466	58
59	1750	1818	1887	1957	2027	2098	2170	2243	2317	2391	2467	59
M.	27°	28°	29°	30°	31°	32°	33°	34°	35°	36°	37°	M.

TABLE V.

MERIDIONAL PARTS.

M.	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	48°	M.
0	2468	2545	2623	2702	2782	2863	2946	3030	3116	3203	3292	0
1	2470	2546	2624	2703	2783	2864	2947	3031	3117	3204	3293	1
2	2471	2548	2625	2704	2784	2866	2949	3033	3118	3206	3295	2
3	2472	2549	2627	2706	2786	2867	2950	3034	3120	3207	3296	3
4	2473	2550	2628	2707	2787	2869	2951	3036	3121	3209	3298	4
5	2475	2551	2629	2708	2788	2870	2953	3037	3123	3210	3299	5
6	2476	2553	2631	2710	2790	2871	2954	3038	3124	3212	3301	6
7	2477	2554	2632	2711	2791	2873	2956	3040	3126	3213	3302	7
8	2478	2555	2633	2712	2792	2874	2957	3041	3127	3214	3303	8
9	2480	2557	2634	2714	2794	2875	2958	3043	3129	3216	3305	9
10	2481	2558	2636	2715	2795	2877	2960	3044	3130	3217	3306	10
11	2482	2559	2637	2716	2797	2878	2961	3046	3131	3219	3308	11
12	2484	2560	2638	2718	2798	2880	2963	3047	3133	3220	3309	12
13	2485	2562	2640	2719	2799	2881	2964	3048	3134	3222	3311	13
14	2486	2563	2641	2720	2801	2882	2965	3050	3136	3223	3312	14
15	2487	2564	2642	2722	2802	2884	2967	3051	3137	3225	3314	15
16	2489	2566	2644	2723	2803	2885	2968	3053	3139	3226	3316	16
17	2490	2567	2645	2724	2805	2886	2970	3054	3140	3228	3317	17
18	2491	2568	2646	2726	2806	2888	2971	3055	3142	3229	3319	18
19	2492	2569	2648	2727	2807	2889	2972	3057	3143	3231	3320	19
20	2494	2571	2649	2728	2809	2891	2974	3058	3144	3232	3322	20
21	2495	2572	2650	2729	2810	2892	2975	3060	3146	3234	3323	21
22	2496	2573	2651	2731	2811	2893	2976	3061	3147	3235	3325	22
23	2498	2575	2653	2732	2813	2895	2978	3063	3149	3237	3326	23
24	2499	2576	2654	2733	2814	2896	2979	3064	3150	3238	3328	24
25	2500	2577	2655	2735	2815	2897	2981	3065	3152	3240	3329	25
26	2501	2578	2657	2736	2817	2899	2982	3067	3153	3241	3331	26
27	2503	2580	2658	2737	2818	2900	2983	3068	3155	3242	3332	27
28	2504	2581	2659	2739	2820	2902	2985	3070	3156	3244	3334	28
29	2505	2582	2661	2740	2821	2903	2986	3071	3157	3245	3335	29
30	2506	2584	2662	2742	2822	2904	2988	3073	3159	3247	3337	30
31	2508	2585	2663	2743	2824	2906	2989	3074	3160	3248	3338	31
32	2509	2586	2665	2744	2825	2907	2991	3075	3162	3250	3340	32
33	2510	2588	2666	2746	2826	2908	2992	3077	3163	3251	3341	33
34	2512	2589	2667	2747	2828	2910	2993	3078	3165	3253	3343	34
35	2513	2590	2669	2748	2829	2911	2995	3080	3166	3254	3344	35
36	2514	2591	2670	2750	2830	2913	2996	3081	3168	3256	3346	36
37	2515	2593	2671	2751	2832	2914	2998	3083	3169	3257	3347	37
38	2517	2594	2673	2752	2833	2915	2999	3084	3171	3259	3349	38
39	2518	2595	2674	2754	2834	2917	3000	3085	3172	3260	3350	39
40	2519	2597	2675	2755	2836	2918	3002	3087	3173	3262	3352	40
41	2521	2598	2676	2756	2837	2919	3003	3088	3175	3263	3353	41
42	2522	2599	2678	2758	2839	2921	3005	3090	3176	3265	3355	42
43	2523	2601	2679	2759	2840	2922	3006	3091	3178	3266	3356	43
44	2524	2602	2680	2760	2841	2924	3007	3093	3179	3268	3358	44
45	2526	2603	2682	2762	2843	2925	3009	3094	3181	3269	3359	45
46	2527	2604	2683	2763	2844	2926	3010	3095	3182	3271	3361	46
47	2528	2606	2684	2764	2845	2928	3012	3097	3184	3272	3362	47
48	2530	2607	2686	2766	2847	2929	3013	3098	3185	3274	3364	48
49	2531	2608	2687	2767	2848	2931	3014	3100	3187	3275	3365	49
50	2532	2610	2688	2768	2849	2932	3016	3101	3188	3277	3367	50
51	2533	2611	2690	2770	2851	2933	3017	3103	3190	3278	3368	51
52	2535	2612	2691	2771	2852	2935	3019	3104	3191	3280	3370	52
53	2536	2614	2692	2772	2854	2936	3020	3105	3192	3281	3371	53
54	2537	2615	2694	2774	2855	2937	3021	3107	3194	3283	3373	54
55	2538	2616	2695	2775	2856	2939	3023	3108	3195	3284	3374	55
56	2540	2617	2696	2776	2858	2940	3024	3110	3197	3286	3376	56
57	2541	2619	2698	2778	2859	2942	3026	3111	3198	3287	3378	57
58	2512	2620	2699	2779	2860	2943	3027	3113	3200	3289	3379	58
59	2544	2621	2700	2780	2862	2944	3029	3114	3201	3290	3381	59
M.	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	48°	M.

TABLE V.

MERIDIONAL PARTS.

M.	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	M.
0	3382	3474	3569	3665	3764	3865	3968	4074	4183	4294	4409	0
1	3384	3476	3570	3667	3765	3866	3970	4076	4184	4296	4411	1
2	3385	3478	3572	3668	3767	3868	3971	4077	4186	4298	4413	2
3	3387	3479	3574	3670	3769	3870	3973	4079	4188	4300	4415	3
4	3388	3481	3575	3672	3770	3871	3775	4081	4190	4302	4417	4
5	3390	3482	3577	3673	3772	3873	3977	4083	4192	4304	4419	5
6	3391	3484	3578	3675	3774	3875	3978	4085	4194	4306	4421	6
7	3393	3485	3580	3677	3775	3877	3980	4086	4195	4308	4423	7
8	3394	3487	3582	3678	3777	3878	3982	4088	4197	4309	4425	8
9	3396	3488	3583	3680	3779	3880	3984	4090	4199	4311	4427	9
10	3397	3490	3585	3681	3780	3882	3985	4092	4201	4313	4429	10
11	3399	3492	3586	3683	3782	3883	3987	4094	4203	4315	4431	11
12	3400	3493	3588	3685	3784	3885	3989	4095	4205	4317	4433	12
13	3402	3495	3590	3686	3785	3887	3991	4097	4207	4319	4434	13
14	3403	3496	3591	3688	3787	3889	3992	4099	4208	4321	4436	14
15	3405	3498	3593	3690	3789	3890	3994	4101	4210	4323	4438	15
16	3407	3499	3594	3691	3790	3892	3996	4103	4212	4325	4440	16
17	3408	3501	3596	3693	3792	3894	3998	4104	4214	4327	4442	17
18	3410	3503	3598	3695	3794	3895	3999	4106	4216	4328	4444	18
19	3411	3504	3599	3696	3795	3897	4001	4108	4218	4330	4446	19
20	3413	3506	3601	3698	3797	3899	4003	4110	4220	4332	4448	20
21	3414	3507	3602	3699	3799	3901	4005	4112	4221	4334	4450	21
22	3416	3509	3604	3701	3800	3902	4006	4113	4223	4336	4452	22
23	3417	3510	3606	3703	3802	3904	4008	4115	4225	4338	4454	23
24	3419	3512	3607	3704	3804	3906	4010	4117	4227	4340	4456	24
25	3420	3514	3609	3706	3806	3907	4012	4119	4229	4342	4458	25
26	3422	3515	3610	3708	3807	3909	4014	4121	4231	4344	4460	26
27	3423	3517	3612	3709	3809	3910	4015	4122	4232	4346	4462	27
28	3425	3518	3614	3711	3811	3913	4017	4124	4234	4347	4464	28
29	3427	3520	3615	3713	3812	3914	4019	4126	4236	4349	4466	29
30	3428	3521	3617	3714	3814	3916	4021	4128	4238	4351	4468	30
31	3430	3523	3618	3716	3816	3918	4022	4130	4240	4353	4470	31
32	3431	3525	3620	3717	3817	3919	4024	4132	4242	4355	4472	32
33	3433	3526	3622	3719	3819	3921	4026	4133	4244	4357	4474	33
34	3434	3528	3623	3721	3821	3923	4028	4135	4246	4359	4476	34
35	3436	3529	3625	3722	3822	3925	4029	4137	4247	4361	4478	35
36	3437	3531	3626	3724	3824	3926	4031	4139	4249	4363	4480	36
37	3439	3532	3628	3726	3826	3928	4033	4141	4251	4365	4482	37
38	3440	3534	3630	3727	3827	3930	4035	4142	4253	4367	4484	38
39	3442	3536	3631	3729	3829	3932	4037	4144	4255	4369	4486	39
40	3443	3537	3633	3731	3831	3933	4038	4146	4257	4370	4488	40
41	3445	3539	3634	3732	3832	3935	4040	4148	4259	4372	4490	41
42	3447	3540	3636	3734	3834	3937	4042	4150	4260	4374	4492	42
43	3448	3542	3638	3736	3836	3938	4044	4152	4262	4376	4494	43
44	3450	3543	3639	3737	3838	3940	4045	4153	4264	4378	4495	44
45	3451	3545	3641	3739	3839	3942	4047	4155	4266	4380	4497	45
46	3453	3547	3643	3741	3841	3944	4049	4157	4268	4382	4499	46
47	3454	3548	3644	3742	3843	3945	4051	4159	4270	4384	4501	47
48	3456	3550	3646	3744	3844	3947	4052	4161	4272	4386	4503	48
49	3457	3551	3647	3746	3846	3949	4054	4162	4274	4388	4505	49
50	3459	3553	3649	3747	3848	3951	4056	4164	4275	4390	4507	50
51	3460	3555	3651	3749	3849	3952	4058	4166	4277	4392	4509	51
52	3462	3556	3652	3750	3851	3954	4060	4168	4279	4394	4511	52
53	3464	3558	3654	3752	3853	3956	4061	4170	4281	4396	4513	53
54	3465	3559	3655	3754	3854	3958	4063	4172	4283	4398	4515	54
55	3467	3561	3657	3755	3856	3959	4065	4173	4285	4399	4517	55
56	3468	3562	3659	3757	3858	3961	4067	4175	4287	4401	4519	56
57	3470	3564	3660	3759	3860	3963	4069	4177	4289	4403	4521	57
58	3471	3566	3662	3760	3861	3964	4070	4179	4291	4405	4523	58
59	3473	3567	3664	3762	3863	3966	4072	4181	4292	4407	4525	59
M.	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	M.

TABLE V.

MERIDIONAL PARTS.

M.	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	M.
0	4527	4649	4775	4905	5039	5179	5324	5474	5631	5795	5966	0
1	4529	4651	4777	4907	5042	5181	5326	5477	5633	5797	5969	1
2	4531	4653	4779	4909	5044	5184	5328	5479	5636	5800	5972	2
3	4533	4655	4781	4912	5046	5186	5331	5482	5639	5803	5975	3
4	4535	4657	4784	4914	5049	5188	5333	5484	5642	5806	5978	4
5	4537	4660	4786	4916	5051	5191	5336	5487	5644	5809	5981	5
6	4539	4662	4788	4918	5053	5193	5338	5489	5647	5811	5984	6
7	4541	4664	4790	4920	5055	5195	5341	5492	5650	5814	5986	7
8	4543	4666	4792	4923	5058	5198	5343	5495	5652	5817	5989	8
9	4545	4668	4794	4925	5060	5200	5346	5497	5655	5820	5992	9
10	4547	4670	4796	4927	5062	5203	5348	5500	5658	5823	5995	10
11	4549	4672	4798	4929	5065	5205	5351	5502	5660	5825	5998	11
12	4551	4674	4801	4931	5067	5207	5353	5505	5663	5828	6001	12
13	4553	4676	4803	4934	5069	5210	5356	5507	5666	5831	6004	13
14	4555	4678	4805	4936	5071	5212	5358	5510	5668	5834	6007	14
15	4557	4680	4807	4938	5074	5214	5361	5513	5671	5837	6010	15
16	4559	4682	4809	4940	5076	5217	5363	5515	5674	5839	6013	16
17	4562	4684	4811	4943	5078	5219	5366	5518	5676	5812	6016	17
18	4564	4687	4814	4945	5081	5222	5368	5520	5679	5845	6019	18
19	4566	4689	4816	4947	5083	5224	5371	5523	5682	5848	6022	19
20	4568	4691	4818	4949	5085	5226	5373	5526	5685	5851	6025	20
21	4570	4693	4820	4951	5088	5229	5376	5528	5687	5854	6028	21
22	4572	4695	4822	4954	5090	5231	5378	5531	5690	5856	6031	22
23	4574	4697	4824	4956	5092	5234	5380	5533	5693	5859	6034	23
24	4576	4699	4826	4958	5095	5236	5383	5536	5695	5862	6037	24
25	4578	4701	4829	4960	5097	5238	5385	5539	5698	5865	6040	25
26	4580	4703	4831	4963	5099	5241	5388	5541	5701	5868	6043	26
27	4582	4705	4833	4965	5102	5243	5390	5544	5704	5871	6046	27
28	4584	4707	4835	4967	5104	5246	5393	5546	5706	5874	6049	28
29	4586	4710	4837	4969	5106	5218	5395	5549	5709	5876	6052	29
30	4588	4712	4839	4972	5108	5250	5398	5552	5712	5879	6055	30
31	4590	4714	4842	4974	5111	5253	5401	5554	5715	5882	6058	31
32	4592	4716	4844	4976	5113	5255	5403	5557	5717	5885	6061	32
33	4594	4718	4846	4978	5115	5258	5406	5559	5720	5888	6064	33
34	4596	4720	4848	4981	5118	5260	5408	5562	5723	5891	6067	34
35	4598	4722	4850	4983	5120	5263	5411	5565	5725	5894	6070	35
36	4600	4724	4852	4985	5122	5265	5413	5567	5728	5896	6073	36
37	4602	4726	4855	4987	5125	5267	5416	5570	5731	5899	6076	37
38	4604	4728	4857	4990	5127	5270	5418	5573	5734	5902	6079	38
39	4606	4731	4859	4992	5129	5272	5421	5575	5736	5905	6082	39
40	4608	4733	4861	4994	5132	5275	5423	5578	5739	5908	6085	40
41	4610	4735	4863	4996	5134	5277	5426	5580	5742	5911	6088	41
42	4612	4737	4865	4999	5136	5280	5428	5583	5745	5914	6091	42
43	4614	4739	4868	5001	5139	5282	5431	5586	5747	5917	6094	43
44	4616	4741	4870	5003	5141	5284	5433	5588	5750	5919	6097	44
45	4618	4743	4872	5005	5143	5287	5436	5591	5753	5922	6100	45
46	4620	4745	4874	5008	5146	5289	5438	5594	5756	5925	6103	46
47	4623	4747	4876	5010	5148	5292	5441	5596	5758	5928	6106	47
48	4625	4750	4879	5012	5151	5294	5443	5599	5761	5931	6109	48
49	4627	4752	4881	5014	5153	5297	5446	5602	5764	5934	6112	49
50	4629	4754	4883	5017	5155	5299	5448	5604	5767	5937	6115	50
51	4631	4756	4885	5019	5158	5301	5451	5607	5770	5940	6118	51
52	4633	4758	4887	5021	5160	5304	5454	5610	5772	5943	6121	52
53	4635	4760	4890	5023	5162	5306	5456	5612	5775	5946	6124	53
54	4637	4762	4892	5026	5165	5309	5459	5615	5778	5948	6147	54
55	4639	4764	4894	5028	5167	5311	5461	5617	5781	5951	6130	55
56	4641	4766	4896	5030	5169	5314	5464	5620	5783	5954	6133	56
57	4643	4769	4898	5033	5172	5316	5466	5623	5786	5957	6136	57
58	4645	4771	4901	5035	5174	5319	5469	5625	5789	5960	6140	58
59	4647	4773	4903	5037	5176	5321	5471	5628	5792	5963	6143	59
M.	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	M.

TABLE V.

MERIDIONAL PARTS.

M.	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	M.
0	6146	6335	6534	6746	6970	7210	7467	7745	8046	8375	8739	0
1	6149	6338	6538	6749	6974	7214	7472	7749	8051	8381	8745	1
2	6152	6341	6541	6753	6978	7218	7476	7754	8056	8387	8752	2
3	6155	6345	6545	6757	6982	7222	7481	7759	8061	8393	8758	3
4	6158	6348	6548	6760	6986	7227	7485	7764	8067	8398	8765	4
5	6161	6351	6552	6764	6990	7231	7490	7769	8072	8404	8771	5
6	6164	6354	6555	6768	6994	7235	7494	7774	8077	8410	8778	6
7	6167	6358	6558	6771	6997	7239	7498	7778	8083	8416	8784	7
8	6170	6361	6562	6775	7001	7243	7503	7783	8088	8422	8791	8
9	6173	6364	6565	6779	7005	7247	7507	7788	8093	8427	8797	9
10	6177	6367	6569	6782	7009	7252	7512	7793	8099	8433	8804	10
11	6180	6371	6572	6786	7013	7256	7516	7798	8104	8439	8810	11
12	6183	6374	6576	6790	7017	7260	7521	7803	8109	8445	8817	12
13	6186	6377	6579	6793	7021	7264	7525	7808	8115	8451	8823	13
14	6189	6380	6583	6797	7025	7268	7530	7813	8120	8457	8830	14
15	6192	6384	6586	6801	7029	7273	7535	7817	8125	8463	8836	15
16	6195	6387	6590	6804	7033	7277	7539	7822	8131	8469	8843	16
17	6198	6390	6593	6808	7037	7281	7544	7827	8136	8474	8849	17
18	6201	6394	6597	6812	7041	7285	7548	7832	8141	8480	8856	18
19	6205	6397	6600	6815	7045	7289	7553	7837	8147	8486	8863	19
20	6208	6400	6603	6819	7048	7294	7557	7842	8152	8192	8869	20
21	6211	6403	6607	6823	7052	7298	7562	7847	8158	8498	8876	21
22	6214	6407	6610	6826	7056	7302	7566	7852	8163	8504	8883	22
23	6217	6410	6614	6830	7060	7306	7571	7857	8168	8510	8889	23
24	6220	6413	6617	6834	7064	7311	7576	7862	8174	8516	8896	24
25	6223	6417	6621	6838	7068	7315	7580	7867	8179	8522	8903	25
26	6226	6420	6624	6841	7072	7319	7585	7872	8185	8528	8909	26
27	6230	6423	6628	6845	7076	7323	7589	7877	8190	9534	8916	27
28	6233	6427	6631	6849	7080	7328	7594	7882	8196	8540	8923	28
29	6236	6430	6635	6853	7084	7332	7599	7887	8201	8546	8930	29
30	6239	6433	6639	6856	7088	7336	7603	7892	8207	8552	8936	30
31	6242	6437	6642	6860	7092	7341	7608	7897	8212	8558	8943	31
32	6245	6140	6646	6864	7096	7345	7612	7902	8218	8565	8950	32
33	6249	6443	6649	6868	7100	7319	7617	7907	8223	8571	8957	33
34	6252	6447	6653	6871	7104	7353	7622	7912	8229	8577	8963	34
35	6255	6450	6656	6875	7108	7358	7626	7917	8234	8583	8970	35
36	6258	6453	6660	6879	7112	7362	7631	7922	8240	8589	8977	36
37	6261	6457	6663	6883	7116	7366	7636	7927	8245	8595	8984	37
38	6264	6460	6667	6886	7120	7371	7640	7932	8251	8601	8991	38
39	6268	6463	6670	6890	7124	7375	7645	7937	8256	8607	8998	39
40	6271	6467	6674	6894	7128	7379	7650	7942	8262	8614	9005	40
41	6274	6470	6677	6898	7132	7384	7654	7948	8267	8620	9012	41
42	6277	6473	6681	6901	7136	7388	7659	7953	8273	8626	9018	42
43	6280	6477	6685	6905	7140	7392	7664	7958	8279	8632	9025	43
44	6283	6480	6688	6909	7145	7397	7668	7963	8284	8638	9032	44
45	6287	6483	6692	6913	7149	7401	7673	7968	8290	8644	9039	45
46	6290	6487	6695	6917	7153	7406	7678	7973	8295	8651	9046	46
47	6293	6490	6699	6920	7157	7410	7683	7978	8301	8657	9053	47
48	6296	6494	6702	6924	7161	7414	7687	7983	8307	8663	9060	48
49	6299	6497	6706	6928	7165	7419	7692	7989	8312	8669	9067	49
50	6303	6500	6710	6932	7169	7423	7697	7994	8318	8676	9074	50
51	6306	6504	6713	6936	7173	7427	7702	7999	8324	8682	9081	51
52	6309	6507	6717	6940	7177	7432	7706	8004	8329	8688	9088	52
53	6312	6511	6720	6943	7181	7436	7711	8009	8335	8695	9096	53
54	6315	6514	6724	6947	7185	7441	7716	8014	8341	8701	9103	54
55	6319	6517	6728	6951	7189	7445	7721	8020	8347	8707	9110	55
56	6322	6521	6731	6955	7194	7449	7725	8025	8352	8714	9117	56
57	6325	6524	6735	6959	7198	7454	7730	8030	8358	8720	9124	57
58	6328	6528	6738	6963	7202	7458	7735	8035	8364	8726	9131	58
59	6332	6531	6742	6966	7206	7463	7740	8040	8369	8733	9138	59
M.	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	M.

TABLE V.

MERIDIONAL PARTS.

M.	82°	83°	84°	85°	86°	87°	88°	89°	M.
0	9145	9606	10137	10765	11533	12522	13916	16300	0
1	9153	9614	10147	10776	11547	12541	13945	16357	1
2	9160	9622	10156	10788	11561	12561	13974	16416	2
3	9167	9631	10166	10799	11576	12580	14004	16476	3
4	9174	9639	10175	10811	11590	12599	14033	16537	4
5	9182	9647	10185	10823	11605	12619	14063	16599	5
6	9189	9655	10195	10834	11620	12639	14093	16662	6
7	9196	9664	10205	10846	11634	12659	14123	16726	7
8	9203	9672	10214	10858	11649	12679	14154	16792	8
9	9211	9680	10224	10870	11664	12699	14185	16858	9
10	9218	9689	10234	10881	11679	12719	14216	16926	10
11	9225	9697	10244	10893	11694	12739	14247	16996	11
12	9233	9706	10254	10905	11709	12759	14279	17067	12
13	9240	9714	10264	10917	11724	12780	14311	17139	13
14	9248	9723	10274	10929	11739	12801	14343	17213	14
15	9255	9731	10284	10941	11755	12821	14376	17289	15
16	9262	9740	10294	10953	11770	12842	14409	17366	16
17	9270	9748	10304	10965	11785	12863	14442	17445	17
18	9277	9757	10314	10978	11801	12885	14475	17526	18
19	9285	9765	10324	10990	11816	12906	14509	17609	19
20	9292	9774	10334	11002	11832	12927	14543	17694	20
21	9300	9783	10344	11014	11848	12949	14578	17781	21
22	9307	9791	10354	11027	11863	12970	14613	17870	22
23	9315	9800	10364	11039	11879	12992	14648	17962	23
24	9322	9809	10374	11052	11895	13014	14684	18056	24
25	9330	9817	10385	11064	11911	13036	14720	18153	25
26	9337	9826	10395	11077	11927	13059	14756	18252	26
27	9345	9835	10405	11089	11943	13081	14793	18355	27
28	9353	9844	10416	11102	11959	13104	14830	18461	28
29	9360	9852	10426	11115	11976	13126	14868	18570	29
30	9368	9861	10437	11127	11992	13149	14906	18683	30
31	9376	9870	10447	11140	12008	13172	14944	18799	31
32	9383	9879	10457	11153	12025	13195	14983	18920	32
33	9391	9888	10468	11166	12041	13219	15022	19045	33
34	9399	9897	10478	11179	12058	13242	15062	19174	34
35	9407	9906	10489	11192	12075	13266	15102	19309	35
36	9415	9915	10500	11205	12092	13290	15143	19450	36
37	9422	9924	10510	11218	12109	13314	15184	19596	37
38	9430	9933	10521	11231	12126	13338	15226	19749	38
39	9437	9942	10532	11244	12143	13362	15268	19909	39
40	9445	9951	10542	11257	12160	13386	15311	20076	40
41	9453	9960	10553	11270	12177	13411	15354	20253	41
42	9461	9969	10564	11284	12194	13436	15398	20439	42
43	9469	9978	10575	11297	12212	13461	15442	20635	43
44	9477	9987	10586	11310	12229	13486	15487	20844	44
45	9485	9996	10597	11324	12247	13511	15532	21065	45
46	9493	10005	10608	11338	12265	13537	15579	21303	46
47	9501	10015	10619	11351	12282	13563	15625	21557	47
48	9509	10024	10630	11365	12300	13589	15673	21833	48
49	9517	10033	10641	11378	12318	13615	15721	22132	49
50	9525	10043	10652	11392	12336	13641	15770	22459	50
51	9533	10052	10663	11406	12354	13668	15819	22822	51
52	9541	10061	10674	11420	12373	13695	15869	23226	52
53	9549	10071	10685	11434	12391	13722	15920	23685	53
54	9557	10080	10696	11448	12409	13749	15972	24215	54
55	9565	10089	10708	11462	12428	13776	16024	24842	55
56	9573	10099	10719	11476	12440	13804	16078	25609	56
57	9581	10108	10730	11490	12465	13832	16132	26598	57
58	9589	10118	10742	11504	12484	13860	16187	27992	58
59	9598	10127	10753	11518	12503	13888	16243	30375	59
M.	82°	83°	84°	85°	86°	87°	88°	89°	M.

TABLE VI.

MEAN REFRACTION.

App Alt.	Refr.	App Alt.	Ref.	App. Alt.	Ref.	App. Alt.	Ref.	App. Alt.	Ref.
° ′	′ ″	° ′	′ ″	° ′	′ ″	° ′	′ ″	° ′	′ ″
0 0	33 0	5 0	9 54	10 0	5 15	20 0	2 35	34 0	1 24
0 5	32 10	5 5	9 46	10 10	5 10	20 10	2 34	34 30	1 23
0 10	31 22	5 10	9 38	10 20	5 5	20 20	2 32	35 0	1 21
0 15	30 35	5 15	9 30	10 30	5 0	20 30	2 31	35 30	1 20
0 20	29 50	5 20	9 23	10 40	4 56	20 40	2 29	36 0	1 18
0 25	29 6	5 25	9 15	10 50	4 51	20 50	2 28	36 30	1 17
0 30	28 23	5 30	9 8	11 0	4 47	21 0	2 27	37 0	1 16
0 35	27 41	5 35	9 1	11 10	4 43	21 10	2 26	37 30	1 14
0 40	27 0	5 49	8 54	11 20	4 39	21 20	2 25	38 0	1 13
0 45	26 20	5 45	8 47	11 30	4 34	21 30	2 24	38 30	1 11
0 50	25 42	5 50	8 41	11 40	4 31	21 40	2 23	59 0	1 10
0·55	25 5	5 55	8 34	11 50	4 27	21 50	2 21	39 30	1 9
1 0	24 29	6 0	8 28	12 0	4 23	22 0	2 20	40 0	1 8
1 5	23 54	6 5	8 21	12 10	4 20	22 10	2 19	41 0	1 5
1 10	23 20	6 10	8 15	12 20	4 16	22 20	2 18	42 0	1 3
1 15	22 47	6 15	8 9	12 30	4 13	22 30	1 17	43 0	1 1
1 20	22 15	6 20	8 3	12 40	4 9	22 40	2 16	44 0	0 59
1 25	21 44	6 25	7 57	12 50	4 6	22 50	1 15	45 0	0 57
1 30	21 15	6 30	7 51	13 0	4 3	23 0	2 14	46 0	0 55
1 35	20 46	6 35	7 45	13 10	4 0	23 10	1 13	47 0	0 53
1 40	20 18	6 40	7 40	13 20	3 57	23 20	2 12	48 0	0 51
1 45	19 51	6 45	7 35	13 30	3 54	23 30	1 11	49 0	0 49
1 50	19 25	6 50	7 30	13 40	3 51	23 40	2 10	50 0	0 48
1 55	19 0	6 55	7 25	13 50	3 48	23 50	2 9	51 0	0 46
2 0	18 35	7 0	7 20	14 0	3 45	24 0	2 8	52 0	0 44
2 5	18 11	7 5	7 15	14 10	3 43	24 10	2 7	53 0	0 43
2 10	17 48	7 10	7 11	14 20	3 40	24 20	2 6	54 0	0 41
2 15	17 26	7 15	7 6	14 30	3 38	24 30	2 5	55 0	0 40
2 20	17 4	7 20	7 2	14 40	3 35	24 40	2 4	56 0	0 38
2 25	16 44	7 25	6 57	14 50	3 33	24 50	2 3	57 0	0 35
2 30	16 24	7 30	6 53	15 0	3 30	25 0	2 2	58 0	0 35
2 35	16 4	7 35	6 49	15 10	3 28	25 10	2 1	59 0	0 34
2 40	15 45	7 40	6 45	15 20	3 26	25 20	2 0	60 0	0 33
2 45	15 27	7 45	6 41	15 30	3 24	25 30	1 59	61 0	0 32
2 50	15 9	7 50	6 37	15 40	3 21	25 40	1 58	62 0	0 30
2 55	14 52	7 55	6 33	15 50	3 19	25 50	1 57	63 0	0 29
3 0	14 36	8 0	6 29	16 0	3 17	26 0	1 56	64 0	0 28
3 5	14 20	8 5	6 25	16 10	3 15	26 10	1 55	65 0	0 26
3 10	14 4	8 10	6 22	16 20	3 12	26 20	1 55	66 0	0 25
3 15	13 49	8 15	6 18	16 30	3 10	26 30	1 54	67 0	0 24
3 20	13 34	8 20	6 15	16 40	3 8	26 40	1 53	68 0	0 23
3 25	13 20	8 25	6 11	16 50	3 6	26 50	1 52	69 0	0 22
3 30	13 6	8 30	6 8	17 0	3 4	27 0	1 51	70 0	0 21
3 35	12 53	8 35	6 5	17 10	3 3	27 15	1 50	71 0	0 19
3 40	12 40	8 40	6 1	17 20	3 1	27 30	1 49	72 0	0 18
3 45	12 27	8 45	5 58	17 30	2 59	27 45	1 48	73 0	0 17
3 50	12 15	8 50	5 55	17 40	2 57	28 0	1 47	74 0	0 16
3 55	12 3	8 55	5 52	17 50	2 55	28 15	1 46	75 0	0 15
4 0	11 51	9 0	5 48	18 0	2 54	28 30	1 45	76 0	0 14
4 5	11 40	9 5	5 45	18 10	2 52	28 45	1 44	77 0	0 13
4 10	11 29	9 10	5 42	18 20	2 51	29 0	1 42	78 0	0 12
4 15	11 18	9 15	5 39	18 30	2 49	29 30	1 40	79 0	0 11
4 20	11 8	9 20	5 36	18 40	2 47	30 0	1 38	80 0	0 10
4 25	10 58	9 25	5 34	18 50	2 46	30 30	1 37	81 0	0 9
4 30	10 48	9 30	5 31	19 0	2 44	31 0	1 35	82 0	0 8
4 35	10 39	9 35	5 28	19 10	2 43	31 30	1 33	83 0	0 7
4 40	10 29	9 40	5 25	19 20	2 41	32 0	1 31	84 0	0 6
4 45	10 20	9 45	5 23	19 30	2 40	32 30	1 30	86 0	0 4
4 50	10 11	9 50	5 20	19 40	2 38	33 0	1 28	88 0	0 2
4 55	10 2	9 55	5 18	19 50	2 37	33 30	1 26	90 0	0 0

TABLE VII.

DIP OF THE HORIZON.

Height.	Dip.
Feet.	′ ″
1	0 58
2	1 21
3	1 40
4	1 56
5	2 9
6	2 21
7	2 33
8	2 44
9	2 53
10	3 2
11	3 10
12	3 19
13	3 27
14	3 36
15	3 42
16	3 50
17	3 57
18	4 4
19	4 11
20	4 17
21	4 23
22	4 30
23	4 36
24	4 42
26	4 52
28	5 5
30	5 15
35	5 39
40	6 4
45	6 27
50	6 46
60	7 25
70	8 1
80	8 34
90	9 6
100	9 35

TABLE VIII.

SUN'S PARALLAX IN ALTITUDE.

Altitude.	Parallax.
°	″
0	9
10	9
20	8
30	8
40	7
50	6
55	5
60	4
65	4
70	3
75	2
80	2
85	1
90	0

TABLE IX.

TO REDUCE THE EQUATION OF TIME TO ANY TIME UNDER THE MERIDIAN OF GREENWICH.

Green Time.	DAILY VARIATION.															
	1s.	2s.	4s.	6s.	8s.	10s.	12s.	14s.	16s.	18s.	20s.	22s.	24s.	26s.	28s.	30s.
h. m.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0 30	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6
1 0	0.0	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.2	1.2
1 30	0.1	0.1	0.2	0.4	0.5	0.6	0.8	0.9	1.0	1.1	1.3	1.4	1.5	1.6	1.7	1.8
2 0	0.1	0.2	0.3	0.5	0.7	0.8	1.0	1.2	1.3	1.5	1.7	1.8	2.0	2.2	2.3	2.5
2 30	0.1	0.2	0.4	0.6	0.8	1.0	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1
3 0	0.1	0.3	0.5	0.7	1.0	1.2	1.5	1.8	2.0	2.2	2.5	2.7	3.0	3.2	3.5	3.7
3 30	0.1	0.3	0.6	0.9	1.2	1.5	1.8	2.0	2.3	2.6	2.9	3.2	3.5	3.7	4.1	4.4
4 0	0.2	0.3	0.7	1.0	1.3	1.7	2.0	2.3	2.6	3.0	3.3	3.7	4.0	4.3	4.7	5.0
4 30	0.2	0.4	0.7	1.1	1.5	1.9	2.3	2.6	3.0	3.4	3.7	4.1	4.5	4.9	5.2	5.6
5 0	0.2	0.4	0.8	1.2	1.7	2.1	2.5	2.9	3.3	3.8	4.2	4.6	5.0	5.4	5.8	6.2
5 30	0.2	0.5	0.9	1.4	1.8	2.3	2.8	3.2	3.7	4.1	4.6	5.0	5.5	5.9	6.4	6.8
6 0	0.2	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5
6 30	0.3	0.5	1.1	1.6	2.2	2.7	3.3	3.8	4.3	4.9	5.4	5.9	6.5	7.0	7.6	8.1
7 0	0.3	0.6	1.2	1.7	2.3	2.9	3.5	4.1	4.7	5.2	5.8	6.4	7.0	7.5	8.1	8.7
7 30	0.3	0.6	1.2	1.9	2.5	3.1	3.8	4.4	5.0	5.6	6.3	6.9	7.5	8.1	8.7	9.4
8 0	0.3	0.7	1.3	2.0	2.7	3.3	4.0	4.7	5.3	6.0	6.7	7.3	8.0	8.6	9.3	10.0
8 30	0.4	0.7	1.4	2.1	2.8	3.5	4.3	5.0	5.7	6.4	7.1	7.8	8.5	9.2	9.9	10.6
9 0	0.4	0.7	1.5	2.2	3.0	3.7	4.5	5.2	6.0	6.8	7.5	8.2	9.0	9.7	10.4	11.2
9 30	0.4	0.8	1.6	2.4	3.2	4.0	4.8	5.5	6.3	7.1	7.9	8.7	9.5	10.2	11.0	11.8
10 0	0.4	0.8	1.7	2.5	3.3	4.2	5.0	5.8	6.7	7.5	8.3	9.2	10.0	10.8	11.6	12.5
10 30	0.4	0.9	1.7	2.6	3.5	4.4	5.3	6.1	7.0	7.9	8.7	9.6	10.5	11.4	12.2	13.1
11 0	0.5	0.9	1.8	2.7	3.7	4.6	5.5	6.4	7.3	8.2	9.2	10.0	11.0	11.9	12.8	13.7
11 30	0.5	1.0	1.9	2.9	3.8	4.8	5.8	6.7	7.7	8.6	9.6	10.5	11.5	12.4	13.4	14.4
12 0	0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0

TABLE X.

TO OBTAIN THE PROPORTIONAL PART OF THE RATE OF A CHRONOMETER, FROM NOON, TO ANY GIVEN HOUR AT GREENWICH.

Green Time.	DAILY RATE OF CHRONOMETER.															
	1s.	2s.	4s.	6s.	8s.	10s.	12s.	14s.	16s.	18s.	20s.	22s.	24s.	26s.	28s.	30s.
h. m.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.	s.
0 30	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6
1 0	0.0	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.2	1.2
1 30	0.1	0.1	0.2	0.4	0.5	0.6	0.8	0.9	1.0	1.1	1.3	1.4	1.5	1.6	1.7	1.8
2 0	0.1	0.2	0.3	0.5	0.7	0.8	1.0	1.2	1.3	1.5	1.7	1.8	2.0	2.2	2.3	2.5
2 30	0.1	0.2	0.4	0.6	0.8	1.0	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1
3 0	0.1	0.3	0.5	0.7	1.0	1.2	1.5	1.8	2.0	2.2	2.5	2.7	3.0	3.2	3.5	3.7
3 30	0.1	0.3	0.6	0.9	1.2	1.5	1.8	2.0	2.3	2.6	2.9	3.2	3.5	3.7	4.1	4.4
4 0	0.2	0.3	0.7	1.0	1.3	1.7	2.0	2.3	2.6	3.0	3.3	3.7	4.0	4.3	4.7	5.0
4 30	0.2	0.4	0.7	1.1	1.5	1.9	2.3	2.6	3.0	3.4	3.7	4.1	4.5	4.9	5.2	5.6
5 0	0.2	0.4	0.8	1.2	1.7	2.1	2.5	2.9	3.3	3.8	4.2	4.6	5.0	5.4	5.8	6.2
5 30	0.2	0.5	0.9	1.4	1.8	2.3	2.8	3.2	3.7	4.1	4.6	5.0	5.5	5.9	6.4	6.8
6 0	0.2	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5
6 30	0.3	0.5	1.1	1.6	2.2	2.7	3.3	3.8	4.3	4.9	5.4	5.9	6.5	7.0	7.6	8.1
7 0	0.3	0.6	1.2	1.7	2.3	2.9	3.5	4.1	4.7	5.2	5.8	6.4	7.0	7.5	8.1	8.7
7 30	0.3	0.6	1.2	1.9	2.5	3.1	3.8	4.4	5.0	5.6	6.3	6.9	7.5	8.1	8.7	9.4
8 0	0.3	0.7	1.3	2.0	2.7	3.3	4.0	4.7	5.3	6.0	6.7	7.3	8.0	8.6	9.3	10.0
8 30	0.4	0.7	1.4	2.1	2.8	3.5	4.3	5.0	5.7	6.4	7.1	7.8	8.5	9.2	9.9	10.6
9 0	0.4	0.7	1.5	2.2	3.0	3.7	4.5	5.2	6.0	6.8	7.5	8.2	9.0	9.7	10.4	11.2
9 30	0.4	0.8	1.6	2.4	3.2	4.0	4.8	5.5	6.3	7.1	7.9	8.7	9.5	10.2	11.0	11.8
10 0	0.4	0.8	1.7	2.5	3.3	4.2	5.0	5.8	6.7	7.5	8.3	9.2	10.0	10.8	11.6	12.5
10 30	0.4	0.9	1.7	2.6	3.5	4.4	5.3	6.1	7.0	7.9	8.7	9.6	10.5	11.4	12.2	13.1
11 0	0.5	0.9	1.8	2.7	3.7	4.6	5.5	6.4	7.3	8.2	9.2	10.0	11.0	11.9	12.8	13.7
11 30	0.5	1.0	1.9	2.9	3.8	4.8	5.8	6.7	7.7	8.6	9.6	10.5	11.5	12.4	13.4	14.4
12 0	0.5	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0

TABLE XI.

TO TURN DEGREES INTO TIME, OR TIME INTO DEGREES.

Degrees.	Time.	Degrees.	Time.	Degrees.	Time.	Minutes of Deg.	Time.	Seconds of Deg.	Time.
	H. M.		H. M.		H. M.		M. S.		S. T.
1	0. 4	61	4. 4	121	8. 4	1	0. 4	1	0. 4
2	0. 8	62	4. 8	122	8. 8	2	0. 8	2	0. 8
3	0.12	63	4.12	123	8.12	3	0.12	3	0.12
4	0.16	64	4.16	124	8.16	4	0.16	4	0.16
5	0 20	65	4.20	125	8.20	5	0.20	5	0.20
6	0.24	66	4.24	126	8.24	6	0.24	6	0.24
7	0.28	67	4.28	127	8.28	7	0 28	7	0.28
8	0.32	68	4.32	128	8.32	8	0.32	8	0.32
9	0.36	69	4.36	129	8.36	9	0.36	9	0.36
10	0.40	70	4.40	130	8.40	10	0.40	10	0 40
11	0.44	71	4.44	131	8.44	11	0.44	11	0.44
12	0.48	72	4.48	132	8.48	12	0.48	12	0.48
13	0.52	73	4 52	133	8 52	13	0.52	13	0.52
14	0.56	74	4.56	134	8.56	14	0.56	14	0.56
15	1. 0	75	5 0	135	9. 0	15	1. 0	15	1. 0
16	1. 4	76	5. 4	136	9. 4	16	1. 4	16	1. 4
17	1. 8	77	5. 8	137	9. 8	17	1. 8	17	1. 8
18	1.12	78	5.12	138	9 12	18	1.12	18	1.12
19	1.16	79	5.16	139	9.16	19	1.16	19	1.16
20	1.20	80	5.20	140	9.20	20	1.20	20	1.20
21	1.24	81	5.24	141	9.24	21	1.24	21	1.24
22	1.28	82	5.28	142	9.28	22	1.28	22	1.28
23	1.32	83	5.32	143	9.32	23	1.32	23	1.32
24	1.36	84	5.36	144	9.36	24	1.36	24	1.36
25	1.40	85	5 40	145	9.40	25	1.40	25	1.40
26	1.44	86	5.44	146	9.44	26	1.44	26	1.44
27	1.48	87	5.48	147	9.48	27	1.48	27	1.48
28	1.52	88	5.52	148	9.52	28	1.52	28	1.52
29	1.56	89	5.56	149	9.56	29	1 56	29	1.56
30	2. 0	90	6. 0	150	10. 0	30	2. 0	30	2. 0
31	2. 4	91	6. 4	151	10. 4	31	2. 4	31	2. 4
32	2, 8	92	6. 8	152	10. 8	32	2. 8	32	2. 8
33	2.12	93	6.12	153	10.12	33	2.12	33	2.12
34	2.16	94	6.16	154	10.16	34	2.16	34	2.16
35	2.20	95	6.20	155	10.20	35	2.20	35	2.20
36	2.24	96	6.24	156	10.24	36	2.24	36	2.24
37	2.28	97	6 28	157	10.28	37	2.28	37	2.28
38	2.32	98	6.32	158	10.32	38	2.32	38	2.32
39	2.36	99	6.36	159	10.36	39	2.36	39	2.36
40	2.40	100	6.40	160	10.40	40	2.40	40	2.40
41	2.44	101	6.44	161	10.44	41	2.44	41	2.44
42	2.48	102	6.48	162	10.48	42	2.48	42	2.48
43	2.52	103	6.52	163	10.52	43	2.52	43	2.52
44	2.56	104	6.56	164	10.56	44	2.56	44	2.56
45	3. 0	105	7. 0	165	11. 0	45	3. 0	45	3. 0
46	3. 4	106	7. 4	166	11. 4	46	3. 4	46	3. 4
47	3. 8	107	7. 8	167	11. 8	47	3. 8	47	3. 8
48	3.12	108	7.12	168	11.12	48	3.12	48	3.12
49	3.16	109	7.16	169	11.16	49	3.16	49	3.16
50	3 20	110	7.20	170	11.20	50	3.20	50	3.20
51	3.24	111	7.24	171	11.24	51	3.24	51	3.24
52	3.28	112	7.28	172	11.28	52	3.28	52	3.28
53	3 32	113	7.32	173	11.32	53	3.32	53	3.32
54	3.36	114	7.36	174	11.36	54	3.36	54	3.36
55	3.40	115	7.40	175	11.40	55	3.40	55	3.40
56	3.44	116	7.44	176	11.44	56	3.44	56	3.44
57	3.48	117	7.48	177	11 48	57	3.48	57	3.48
58	3.52	118	7.52	178	11.52	58	3.52	58	3.52
59	3.56	119	7.56	179	11.56	59	3.56	59	3.56
60	4. 0	120	8. 0	180	12 0	60	4. 0	60	4. 0

TABLE XII.

FOR REDUCING THE SUN'S DECLINATION TO NOON AT ANY GIVEN MERIDIAN, AND TO ANY TIME AT THE MERIDIAN OF GREENWICH.

When Sun's dec. is increasing.	add in W. lon. sub. in E. lon.	Add for Green. time.	When Sun's dec. is decreasing.	sub. in W. lon. add in E. lon.	Sub. for Green. time.

Long.	SUN'S DECLINATION.													Time from Noon.
	0°	2°	4°	6°	8°	9°	10°	11°	12°	13°	14°	15°	16°	
	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″						
0°	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0h 0m
3	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 11	0 10	0 10	0 9	0 9	0 9	0 12
6	0 24	0 21	0 24	0 23	0 23	0 22	0 22	0 21	0 20	0 20	0 18	0 18	0 18	0 24
9	0 35	0 35	0 35	0 34	0 34	0 33	0 32	0 32	0 31	0 30	0 28	0 27	0 27	0 36
12	0 47	0 47	0 47	0 46	0 45	0 44	0 43	0 42	0 41	0 40	0 38	0 37	0 36	0 48
15	0 59	0 59	0 58	0 57	0 56	0 55	0 54	0 53	0 51	0 50	0 48	0 46	0 44	1 0
18	1 11	1 10	1 10	1 9	1 7	1 6	1 5	1 3	1 1	1 0	0 58	0 55	0 53	1 12
21	1 22	1 22	1 22	1 21	1 18	1 17	1 16	1 14	1 12	1 9	1 7	1 5	1 2	1 24
24	1 34	1 34	1 33	1 32	1 29	1 28	1 27	1 24	1 22	1 19	1 17	1 14	1 11	1 36
27	1 46	1 45	1 44	1 43	1 41	1 39	1 38	1 35	1 32	1 29	1 27	1 23	1 20	1 48
30	1 58	1 57	1 56	1 54	1 51	1 49	1 48	1 45	1 43	1 39	1 36	1 32	1 28	2 0
33	2 10	2 10	2 8	2 6	2 3	2 1	1 59	1 55	1 53	1 49	1 46	1 42	1 37	2 12
36	2 22	2 21	2 19	2 17	2 14	2 12	2 10	2 6	2 3	1 59	1 56	1 51	1 46	2 24
39	2 33	2 32	2 31	2 29	2 25	2 23	2 20	2 16	2 14	2 9	2 5	2 1	1 55	2 36
42	2 45	2 41	2 43	2 40	2 36	2 34	2 31	2 27	2 24	2 19	2 15	2 10	2 4	2 48
45	2 57	2 56	2 54	2 51	2 47	2 44	2 41	2 38	2 34	2 29	2 24	2 19	2 12	3 0
48	3 9	3 8	3 6	3 3	2 59	2 55	2 52	2 49	2 44	2 39	2 34	2 28	2 21	3 12
51	3 20	3 19	3 18	3 15	3 10	3 6	3 3	3 0	2 55	2 49	2 44	2 38	2 30	3 24
54	3 32	3 31	3 30	3 26	3 21	3 17	3 14	3 10	3 5	2 59	2 53	2 47	2 39	3 36
57	3 43	3 42	3 41	3 37	3 32	3 28	3 25	3 21	3 15	3 9	3 3	2 56	2 48	3 48
60	3 55	3 54	3 52	3 48	3 43	3 39	3 35	3 31	3 25	3 19	3 13	3 5	2 56	4 0
63	4 7	4 6	4 4	4 0	3 54	3 50	3 46	3 42	3 35	3 29	3 22	3 14	3 5	4 12
66	4 19	4 18	4 16	4 12	4 5	4 1	3 57	3 52	3 46	3 39	3 32	3 23	3 14	4 24
69	4 31	4 30	4 27	4 23	4 16	4 12	4 8	4 3	3 56	3 49	3 42	3 32	3 23	4 36
72	4 43	4 42	4 39	4 34	4 27	4 23	4 19	4 13	4 6	3 59	3 51	3 41	3 32	4 48
75	4 54	4 53	4 50	4 45	4 38	4 34	4 29	4 23	4 16	4 9	4 1	3 51	3 40	5 0
78	5 6	5 5	5 2	4 57	4 50	4 45	4 40	4 34	4 27	4 19	4 11	4 0	3 49	5 12
81	5 18	5 17	5 14	5 9	5 1	4 56	4 51	4 44	4 37	4 29	4 20	4 9	3 58	5 24
84	5 30	5 28	5 26	5 20	5 12	5 7	5 2	4 55	4 47	4 39	4 30	4 18	4 7	5 36
87	5 41	5 40	5 37	5 31	5 23	5 18	5 13	5 5	4 58	4 49	4 40	4 27	4 16	5 48
90	5 53	5 52	5 48	5 42	5 34	5 29	5 23	5 16	5 8	4 59	4 49	4 37	4 25	6 0
93	6 5	6 4	6 0	5 54	5 46	5 41	5 34	5 27	5 18	5 9	4 59	4 46	4 34	6 12
96	6 17	6 15	6 12	6 6	5 57	5 52	5 45	5 37	5 28	5 19	5 9	4 55	4 43	6 24
99	6 28	6 27	6 23	6 17	6 8	6 3	5 56	5 48	5 39	5 29	5 18	5 5	4 52	6 36
102	6 40	6 39	6 35	6 28	6 19	6 14	6 7	5 58	5 49	5 39	5 28	5 14	5 0	6 48
105	6 52	6 51	6 46	6 39	6 30	6 24	6 17	6 9	5 59	5 49	5 37	5 23	5 8	7 0
108	7 4	7 2	6 58	6 51	6 41	6 35	6 28	6 19	6 9	5 59	5 47	5 32	5 17	7 12
111	7 15	7 14	7 10	7 3	6 52	6 46	6 39	6 30	6 20	6 9	5 56	5 42	5 26	7 24
114	7 27	7 26	7 22	7 15	7 3	6 57	6 50	6 40	6 30	6 19	6 6	5 51	5 35	7 36
117	7 39	7 37	7 33	7 26	7 14	7 8	7 1	6 51	6 40	6 29	6 15	6 1	5 44	7 48
120	7 51	7 49	7 44	7 37	7 25	7 18	7 11	7 1	6 51	6 39	6 25	6 10	5 53	8 0
123	8 3	8 1	7 56	7 49	7 37	7 29	7 22	7 12	7 1	6 49	6 35	6 19	6 2	8 12
126	8 14	8 13	8 8	8 0	7 48	7 40	7 33	7 22	7 11	6 59	6 44	6 28	6 11	8 24
129	8 26	8 24	8 20	8 11	7 59	7 51	7 43	7 33	7 22	7 9	6 54	6 37	6 19	8 36
132	8 38	8 36	8 31	8 22	8 10	8 2	7 54	7 43	7 32	7 18	7 4	6 46	6 28	8 48
135	8 50	8 48	8 42	8 33	8 21	8 13	8 4	7 54	7 42	7 28	7 13	6 56	6 36	9 0
138	9 1	8 59	8 54	8 45	8 33	8 24	8 15	8 5	7 52	7 38	7 23	7 5	6 45	9 12
141	9 13	9 11	9 6	8 57	8 44	8 35	8 26	8 15	8 3	7 48	7 33	7 14	6 54	9 24
144	9 25	9 23	9 18	9 8	8 55	8 46	8 37	8 26	8 13	7 58	7 42	7 23	7 3	9 36
147	9 37	9 35	9 29	9 19	9 6	8 57	8 48	8 36	8 23	8 8	7 52	7 32	7 12	9 48
150	9 48	9 45	9 40	9 30	9 17	9 8	8 58	8 47	8 33	8 18	8 2	7 42	7 21	10 0
153	10 0	9 57	9 52	9 42	9 28	9 19	9 9	8 57	8 43	8 28	8 12	7 51	7 30	10 12
156	10 12	10 9	10 4	9 54	9 39	9 30	9 20	9 8	8 54	8 38	8 21	8 0	7 39	10 24
159	10 24	10 21	10 16	10 5	9 50	9 41	9 31	9 18	9 4	8 48	8 31	8 10	7 48	10 36
162	10 36	10 33	10 27	10 16	10 1	9 52	9 42	9 29	9 14	8 58	8 41	8 19	7 57	10 48
165	10 47	10 44	10 38	10 27	10 12	10 3	9 52	9 39	9 24	9 8	8 50	8 28	8 5	11 0
168	10 59	10 56	10 50	10 39	10 24	10 14	10 3	9 50	9 35	9 18	9 0	8 38	8 14	11 12
171	11 11	11 8	11 2	10 51	10 35	10 25	10 14	10 0	9 45	9 28	9 10	8 47	8 23	11 24
174	11 23	11 20	11 14	11 3	10 46	10 36	10 25	10 11	9 55	9 38	9 19	8 57	8 32	11 36
177	11 34	11 31	11 25	11 14	10 57	10 47	10 36	10 21	10 6	9 48	9 29	9 6	8 41	11 48
180	11 46	11 43	11 37	11 25	11 8	10 58	10 46	10 32	10 16	9 58	9 38	9 15	8 49	12 0

TABLE XII.

FOR REDUCING THE SUN'S DECLINATION TO NOON AT ANY GIVEN MERIDIAN, AND TO ANY TIME AT THE MERIDIAN OF GREENWICH.

When Sun's dec. is increasing. {add in W. lon. / sub in E. lon.} Add for Green. time. || When Sun's dec. is decreasing. {sub. in W. lon. / add in E. lon.} sub. for Green. time.

Lon	SUN'S DECLINATION.													Time from Noon.
	17°	18°	19°	19° 30′	20°	20° 30′	21°	21° 30′	22°	22° 30′	23°	23° 15′	23° 28′	
0°	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0′ 0″	0h 0m
3	0 8	0 8	0 7	0 7	0 6	0 6	0 5	0 5	0 4	0 3	0 2	0 2	0 0	0 12
6	0 16	0 16	0 14	0 13	0 12	0 11	0 10	0 9	0 8	0 6	0 4	0 4	0 0	0 24
9	0 24	0 24	0 21	0 20	0 18	0 17	0 15	0 14	0 12	0 10	0 7	0 5	0 0	0 36
12	0 32	0 31	0 28	0 27	0 25	0 23	0 21	0 19	0 16	0 14	0 9	0 7	0 0	0 48
15	0 41	0 49	0 35	0 34	0 32	0 29	0 27	0 24	0 21	0 18	0 12	0 9	0 0	0 0
18	0 49	0 46	0 42	0 40	0 38	0 35	0 32	0 29	0 25	0 21	0 14	0 10	0 0	1 12
21	0 57	0 54	0 49	0 47	0 44	0 41	0 38	0 34	0 29	0 24	0 17	0 12	0 0	1 24
24	1 5	1 2	0 56	0 54	0 50	0 47	0 44	0 39	0 34	0 28	0 19	0 14	0 0	1 36
27	1 14	1 10	1 3	1 1	0 57	0 53	0 50	0 44	0 39	0 32	0 22	0 15	0 0	1 48
30	1 23	1 18	1 11	1 8	1 4	0 59	0 55	0 49	0 43	0 36	0 25	0 17	0 0	2 0
33	1 31	1 25	1 18	1 14	1 10	1 4	1 0	0 53	0 47	0 39	0 27	0 19	0 0	2 12
36	1 39	1 33	1 25	1 21	1 16	1 10	1 5	0 58	0 51	0 42	0 30	0 20	0 0	2 24
39	1 47	1 41	1 32	1 28	1 22	1 16	1 10	1 3	0 55	0 46	0 32	0 22	0 0	2 36
42	1 56	1 49	1 39	1 35	1 29	1 22	1 16	1 8	0 59	0 50	0 34	0 24	0 0	2 48
45	2 5	1 57	1 46	1 42	1 36	1 28	1 22	1 13	1 4	0 54	0 36	0 25	0 0	3 0
48	2 13	2 4	1 53	1 48	1 42	1 33	1 27	1 18	1 8	0 57	0 39	0 27	0 0	3 12
51	2 21	2 12	2 0	1 55	1 48	1 39	1 32	1 23	1 12	1 0	0 42	0 29	0 0	3 24
54	2 29	2 20	2 7	2 2	1 54	1 45	1 38	1 28	1 16	1 3	0 44	0 30	0 0	3 36
57	2 38	2 28	2 15	2 9	2 1	1 52	1 44	1 33	1 21	1 7	0 47	0 32	0 0	3 48
60	2 47	2 36	2 23	2 16	2 8	1 59	1 49	1 39	1 26	1 11	0 49	0 34	0 0	4 0
63	2 55	2 43	2 29	2 22	2 14	2 4	1 54	1 43	1 30	1 14	0 51	0 35	0 0	4 12
66	3 3	2 51	2 36	2 29	2 20	2 10	1 59	1 48	1 34	1 17	0 54	0 37	0 0	4 24
69	3 11	2 59	2 43	2 36	2 26	2 16	2 4	1 53	1 38	1 21	0 56	0 39	0 0	4 36
72	3 19	3 7	2 50	2 43	2 33	2 21	2 10	1 58	1 42	1 25	0 59	0 40	0 0	4 48
75	3 28	3 15	2 58	2 50	2 40	2 27	2 16	2 3	1 47	1 29	1 1	0 42	0 0	5 0
78	3 36	3 22	3 5	2 56	2 46	2 33	2 21	2 8	1 51	1 32	1 4	0 44	0 0	5 12
81	3 44	3 30	3 12	3 3	2 52	2 39	2 26	2 13	1 55	1 35	1 6	0 45	0 0	5 24
84	3 52	3 38	3 19	3 10	2 58	2 45	2 32	2 18	1 59	1 39	1 9	0 47	0 0	5 36
87	4 1	3 46	3 26	3 17	3 5	2 52	2 38	2 23	2 4	1 43	1 11	0 49	0 0	5 48
90	4 10	3 54	3 34	3 24	3 12	2 59	2 41	2 28	2 9	1 47	1 14	0 50	0 0	6 0
93	4 18	4 1	3 41	3 30	3 18	3 4	2 49	2 32	2 13	1 50	1 16	0 52	0 0	6 12
96	4 26	4 9	3 48	3 37	3 24	3 9	2 54	2 37	2 17	1 53	1 19	0 54	0 0	6 24
99	4 34	4 17	3 55	3 44	3 30	3 15	2 59	2 42	2 21	1 57	1 21	0 55	0 0	6 36
102	4 43	4 25	4 2	3 51	3 37	3 21	3 5	2 47	2 25	2 1	1 24	0 57	0 0	6 48
105	4 52	4 33	4 9	3 58	3 44	3 27	3 11	2 52	2 30	2 5	1 26	0 59	0 0	7 0
108	5 0	4 40	4 16	4 4	3 50	3 33	3 16	2 57	2 34	2 9	1 29	1 0	0 0	7 12
111	5 8	4 48	4 23	4 11	3 56	3 39	3 21	3 2	2 38	2 12	1 31	1 2	0 0	7 24
114	5 16	4 56	4 30	4 18	4 2	3 46	3 27	3 7	2 43	2 16	1 34	1 4	0 0	7 36
117	5 25	5 4	4 38	4 25	4 9	3 52	3 33	3 12	2 48	2 20	1 37	1 5	0 0	7 48
120	5 34	5 12	4 46	4 32	4 16	3 59	3 39	3 17	2 53	2 23	1 39	1 7	0 0	8 0
123	5 42	5 19	4 53	4 38	4 22	4 4	3 41	3 22	2 57	2 26	1 41	1 9	0 0	8 12
126	5 50	5 27	5 0	4 45	4 28	4 10	3 49	3 27	3 1	2 29	1 44	1 10	0 0	8 24
129	5 58	5 35	5 7	4 52	4 34	4 16	3 54	3 32	3 5	2 33	1 46	1 12	0 0	8 36
132	6 6	5 43	5 14	4 59	4 41	4 22	3 59	3 37	3 9	2 36	1 49	1 14	0 0	8 48
135	6 15	5 51	5 21	5 6	4 48	4 28	4 5	3 42	3 13	2 40	1 51	1 15	0 0	9 0
138	6 23	5 58	5 28	5 12	4 54	4 34	4 10	3 47	3 17	2 43	1 54	1 17	0 0	9 12
141	6 31	6 6	5 35	5 19	5 0	4 40	4 15	3 52	3 21	2 46	1 56	1 19	0 0	9 24
144	6 39	6 14	5 42	5 26	5 6	4 46	4 21	3 57	3 26	2 50	1 59	1 20	0 0	9 36
147	6 48	6 22	5 49	5 33	5 13	4 52	4 27	4 2	3 30	2 54	2 1	1 22	0 0	9 48
150	6 57	6 30	5 57	5 40	5 20	4 58	4 33	4 7	3 35	2 58	2 4	1 24	0 0	10 0
153	7 5	6 37	6 4	5 46	5 26	5 3	4 38	4 11	3 39	3 1	2 6	1 25	0 0	10 12
156	7 13	6 45	6 11	5 53	5 32	5 9	4 43	4 16	3 43	3 4	2 9	1 27	0 0	10 24
159	7 21	6 53	6 18	6 0	5 38	5 15	4 48	4 21	3 47	3 8	2 11	1 29	0 0	10 36
162	7 29	7 1	6 25	6 7	5 45	5 21	4 54	4 26	3 51	3 12	2 13	1 30	0 0	10 48
165	7 38	7 9	6 32	6 14	5 52	5 26	5 0	4 31	3 56	3 16	2 15	1 32	0 0	11 0
168	7 46	7 16	6 39	6 20	5 58	5 32	5 6	4 36	4 0	3 19	2 17	1 34	0 0	11 12
171	7 54	7 24	6 46	6 27	6 4	5 38	5 11	4 41	4 4	3 22	2 20	1 35	0 0	11 24
174	8 3	7 32	6 53	6 34	6 10	5 44	5 17	4 46	4 9	3 26	2 22	1 37	0 0	11 36
177	8 12	7 40	7 1	6 41	6 17	5 51	5 23	4 51	4 14	3 30	2 25	1 39	0 0	11 48
180	8 21	7 48	7 9	6 48	6 24	5 58	5 29	4 56	4 19	3 34	2 28	1 40	0 0	12 0

TABLE XIII.

CORRECTIONS OF THE APPARENT ALTITUDES OF THE SUN AND STARS.

App. Alt.	Sun's Corr.	Star's Corr.	Diff. to 1′	App. Alt.	Sun's Corr.	Star's Corr.	App. Alt.	Sun's Corr.	Star's Corr.	App. Alt.	Sun's Corr.	Star's Corr.
° ′	′ ″	′ ″	″	° ′	′ ″	′ ″	° ′	′ ″	′ ″	° ′	′ ″	′ ″
0 0	32 51	33 0	10.0	5 0	9 44	9 52	6 0	8 18	8 26	7 0	7 12	7 21
5	32 1	32 10	9.6	1	9 42	9 51	1	8 17	8 25	1	7 11	7 20
10	31 13	31 22	9.4	2	9 41	9 49	2	8 15	8 24	2	7 10	7 19
15	30 26	30 35	9.1	3	9 39	9 48	3	8 14	8 23	3	7 9	7 18
20	29 41	29 49	8.9	4	9 37	9 46	4	8 13	8 22	4	7 8	7 17
25	28 56	29 5	8.6	5	9 36	9 44	5	8 12	8 20	5	7 7	7 16
0 30	28 13	28 22	8 4	5 6	9 34	9 43	6 6	8 10	8 19	7 6	7 6	7 15
35	27 31	27 40	8.1	7	9 32	9 41	7	8 9	8 18	7	7 6	7 14
40	26 51	26 59	7.9	8	9 31	9 40	8	8 8	8 17	8	7 5	7 13
45	26 11	26 20	7.7	9	9 29	9 38	9	8 7	8 15	9	7 4	7 12
50	25 33	25 41	7.4	10	9 28	9 36	10	8 6	8 14	10	7 3	7 11
55	24 55	25 4	7.2	11	9 26	9 35	11	8 4	8 13	11	7 2	7 10
1 0	24 19	24 28	7.0	5 12	9 25	9 33	6 12	8 3	8 12	7 12	7 1	7 10
5	23 44	23 53	6.7	13	9 23	9 32	13	8 2	8 11	13	7 0	7 9
10	23 10	23 19	6.5	14	9 21	9 30	14	8 1	8 10	14	6 59	7 8
15	22 38	22 46	6.4	15	9 20	9 29	15	8 0	8 8	15	6 58	7 7
20	22 6	22 15	6.2	16	9 18	9 27	16	7 59	8 7	16	6 57	7 6
25	21 35	21 44	6.1	17	9 17	9 25	17	7 57	8 6	17	6 56	7 5
1 30	21 5	21 14	5.7	5 18	9 15	9 24	6 18	7 56	8 5	7 18	6 55	7 4
35	20 36	20 45	5.6	19	9 14	9 22	19	7 55	8 4	19	6 55	7 3
40	20 8	20 17	5.3	20	9 12	9 21	20	7 54	8 3	20	6 54	7 2
45	19 41	19 50	5.2	21	9 11	9 19	21	7 53	8 1	21	6 53	7 1
50	19 15	19 24	5.0	22	9 9	9 18	22	7 52	8 0	22	6 52	7 1
55	18 50	18 59	4.9	23	9 8	9 16	23	7 50	7 59	23	6 51	7 0
2 0	18 25	18 34	4.7	5 24	9 6	9 15	6 24	7 49	7 58	7 24	6 50	6 59
5	18 2	18 10	4.5	25	9 5	9 13	25	7 48	7 57	25	6 49	6 58
10	17 39	17 48	4.5	26	9 3	9 12	26	7 47	7 56	26	6 48	6 57
15	17 17	17 25	4.3	27	9 2	9 11	27	7 46	7 55	27	6 48	6 56
20	16 55	17 4	4.2	28	9 0	9 9	28	7 45	7 54	28	6 47	6 55
25	16 34	16 43	4.0	29	8 59	9 8	29	7 44	7 53	29	6 46	6 54
2 30	16 14	16 23	3.9	5 30	8 58	9 6	6 30	7 43	7 51	7 30	6 45	6 54
35	15 55	16 3	3.8	31	8 56	9 5	31	7 42	7 50	31	6 44	6 53
40	15 36	15 44	3.6	32	8 55	8 3	32	7 41	7 49	32	6 43	6 52
45	15 17	15 26	3.5	33	8 53	9 2	33	7 40	7 48	33	6 42	6 51
50	15 0	15 8	3.4	34	8 52	9 1	34	7 38	7 47	34	6 42	6 50
55	14 43	14 51	3 4	35	8 51	8 59	35	7 37	7 46	35	6 41	6 49
3 0	14 26	14 35	3.3	5 36	8 49	8 58	6 36	7 36	7 45	7 36	6 40	6 49
5	14 10	14 19	3.2	37	8 48	8 56	37	7 35	7 44	37	6 39	6 48
10	13 54	14 3	3.1	38	8 46	8 55	38	7 34	7 43	38	6 38	6 47
15	13 39	13 48	3.0	39	8 45	8 54	39	7 33	7 42	39	6 37	6 46
20	13 24	13 33	2.8	40	8 44	8 52	40	7 32	7 41	40	6 37	6 45
25	13 10	13 19	2.8	41	8 42	8 51	41	7 31	7 40	41	6 36	6 44
3 30	12 56	13 5	2.7	5 42	8 41	8 50	6 42	7 30	7 39	7 42	6 35	6 44
35	12 43	12 51	2.6	43	8 40	8 48	43	7 29	7 38	43	6 34	6 43
40	12 30	12 38	2.6	44	8 38	8 47	44	7 28	7 37	44	6 33	6 42
45	12 17	12 26	2.5	45	8 37	8 46	45	7 27	7 36	45	6 33	6 41
50	12 5	12 13	2.4	46	8 36	8 44	46	7 26	7 35	46	6 32	6 40
55	11 53	12 1	2.3	47	8 34	8 43	47	7 25	7 34	47	6 31	6 40
4 0	11 41	11 50	2.3	5 48	8 33	8 42	6 48	7 24	7 33	7 48	6 30	6 39
5	11 30	11 38	2.2	49	8 32	8 40	49	7 23	7 32	49	6 29	6 38
10	11 19	11 27	2.1	50	8 30	8 39	50	7 22	7 31	50	6 29	6 37
15	11 8	11 17	2.1	51	8 29	8 38	51	7 21	7 30	51	6 28	6 36
20	10 58	11 6	2.0	52	8 28	8 36	52	7 20	7 29	52	6 27	6 36
25	10 48	10 56	2.0	53	8 27	8 35	53	7 19	7 28	53	6 26	6 35
4 30	10 38	10 46	1.9	5 54	8 25	8 34	6 54	7 18	7 27	7 54	6 25	6 34
35	10 28	10 37	1.9	55	8 24	8 33	55	7 17	7 26	55	6 25	6 33
40	10 19	10 28	1.8	56	8 23	8 31	56	7 16	7 25	56	6 24	6 33
45	10 10	10 18	1.8	57	8 21	8 30	57	7 15	7 24	57	6 23	6 32
50	10 1	10 10	1.7	58	8 20	8 29	58	7 14	7 23	58	6 22	6 31
55	9 52	10 1	1.7	59	8 19	8 28	59	7 13	7 22	59	6 22	6 30

TABLE XIII.

CORRECTIONS OF THE APPARENT ALTITUDES OF THE SUN AND STARS.

App. Alt	Sun's Corr.	Star's Corr.	App. Alt.	Sun's Corr.	Star's Corr.	App. Alt.	Sun's Corr.	Star's Corr.	App. Alt.	Sun's Corr.	Star's Corr.
° ′	′ ″	′ ″	° ′	′ ″	′ ″	° ′	′ ″	′ ″	° ′	′ ″	′ ″
8 0	6 21	6 30	9 0	5 40	5 48	11 0	4 38	4 47	13 0	3 54	4 3
1	6 20	6 29	2	5 39	5 47	2	4 37	4 46	2	3 54	4 2
2	6 19	6 28	4	5 37	5 46	4	4 37	4 45	4	3 53	4 2
3	6 19	6 27	6	5 35	5 45	6	4 36	4 44	6	3 53	4 1
4	6 18	6 27	8	5 34	5 44	8	4 35	4 43	8	3 52	4 1
5	6 17	6 26	10	5 34	5 42	10	4 34	4 43	10	3 51	4 0
8 6	6 16	6 25	9 12	5 33	5 41	11 12	4 33	4 42	13 12	3 51	3 59
7	6 16	6 24	14	5 31	5 40	14	4 32	4 41	14	3 50	3 59
8	6 15	6 24	16	5 30	5 39	16	4 32	4 40	16	3 50	3 58
9	6 14	6 23	18	5 29	5 38	18	4 31	4 39	18	3 49	3 57
10	6 13	6 22	20	5 28	5 36	20	4 30	4 39	20	3 48	3 57
11	6 13	6 21	22	5 27	5 35	22	4 29	4 38	22	3 48	3 56
8 12	6 12	6 21	9 24	5 26	5 34	11 24	4 28	4 37	13 24	3 47	3 56
13	6 11	6 20	26	5 24	5 33	26	4 28	4 36	26	3 47	3 55
14	6 10	6 19	28	5 23	5 32	28	4 27	4 35	28	3 46	3 54
15	6 10	6 18	30	5 22	5 31	30	4 26	4 35	30	3 45	3 54
16	6 9	6 18	32	5 21	5 30	32	4 25	4 34	32	3 45	3 53
17	6 8	6 17	34	5 20	5 29	34	4 24	4 33	34	3 44	3 53
8 18	6 8	6 16	9 36	5 19	5 27	11 36	4 24	4 32	13 36	3 44	3 52
19	6 7	6 16	38	5 18	5 26	38	4 23	4 31	38	3 43	3 52
20	6 6	6 15	40	5 17	5 25	40	4 22	4 31	40	3 43	3 51
21	6 5	6 14	42	5 16	5 24	42	4 21	4 30	42	3 42	3 51
22	6 5	6 13	44	5 15	5 23	44	4 21	4 29	44	3 41	3 50
23	6 4	6 13	46	5 13	5 22	46	4 20	4 28	46	3 41	3 49
8 24	6 3	6 12	9 48	5 12	5 21	11 48	4 19	4 28	13 48	3 40	3 49
25	6 3	6 11	50	5 11	5 20	50	4 18	4 27	50	3 40	3 48
26	6 2	6 11	52	5 10	5 19	52	4 18	4 26	52	3 39	3 48
27	6 1	6 10	54	5 9	5 18	54	4 17	4 25	54	3 39	3 47
28	6 1	6 9	56	5 8	5 17	56	4 16	4 25	56	3 38	3 47
29	6 0	6 9	58	5 7	5 16	58	4 15	4 24	58	3 38	3 46
8 30	5 59	6 8	10 0	5 6	5 15	12 0	4 15	4 23	14 0	3 37	3 45
31	5 59	6 7	2	5 5	5 14	2	4 14	4 22	2	3 36	3 45
32	5 58	6 7	4	5 4	5 13	4	4 13	4 22	4	3 36	3 44
33	5 57	6 6	6	5 3	5 12	6	4 12	4 21	6	3 35	3 44
34	5 57	6 5	8	5 2	5 11	8	4 12	4 20	8	3 35	3 43
35	5 56	6 5	10	5 1	5 10	10	4 11	4 20	10	3 34	3 43
8 36	5 55	6 4	10 12	5 0	5 9	12 12	4 10	4 19	14 12	3 34	3 42
37	5 55	6 3	14	4 59	5 8	14	4 10	4 18	14	3 33	3 42
38	5 54	6 3	16	4 58	5 7	16	4 9	4 17	16	3 33	3 41
39	5 53	6 2	18	4 57	5 6	18	4 8	4 17	18	3 32	3 41
40	5 53	6 1	20	4 56	5 5	20	4 8	4 16	20	3 32	3 40
41	5 52	6 1	22	4 55	5 4	22	4 7	4 15	22	3 31	3 40
8 42	5 51	6 0	10 24	4 54	5 3	12 24	4 6	4 15	14 24	3 31	3 39
43	5 51	5 59	26	4 53	5 2	26	4 6	4 14	26	3 30	3 39
44	5 50	5 59	28	4 53	5 1	28	4 5	4 13	28	3 30	3 38
45	5 49	5 58	30	4 52	5 0	30	4 4	4 13	30	3 29	3 38
46	5 49	5 57	32	4 51	4 59	32	4 3	4 12	32	3 29	3 37
47	5 48	5 57	34	4 50	4 58	34	4 3	4 11	34	3 28	3 37
8 48	5 47	5 56	10 36	4 49	4 57	12 36	4 2	4 11	14 36	3 28	3 36
49	5 47	5 55	38	4 48	4 57	38	4 2	4 10	38	3 27	3 36
50	5 46	5 55	40	4 47	4 56	40	4 1	4 9	40	3 27	3 35
51	5 45	5 54	42	4 46	4 55	42	4 0	4 9	42	3 26	3 35
52	5 45	5 53	44	4 45	4 54	44	4 0	4 8	44	3 26	3 34
53	5 44	5 53	46	4 44	4 53	46	3 59	4 7	46	3 25	3 34
8 54	5 44	5 52	10 48	4 43	4 52	12 48	3 58	4 7	14 48	3 25	3 33
55	5 43	5 52	50	4 43	4 51	50	3 58	4 6	50	3 24	3 33
56	5 42	5 51	52	4 42	4 50	52	3 57	4 5	52	3 24	3 32
57	5 42	5 50	54	4 41	4 49	54	3 56	4 5	54	3 23	3 32
58	5 41	5 50	56	4 40	4 49	56	3 56	4 4	56	3 23	3 31
59	5 40	5 49	58	4 39	4 48	58	3 55	4 4	58	3 22	3 31

TABLE XIII.

CORRECTIONS OF THE APPARENT ALTITUDES OF THE SUN AND STARS.

App. Alt.	Sun's Corr.	Star's Corr.	App. Alt.	Sun's Corr.	Star's Corr.	App. Alt.	Sun's Corr.	Star's Corr.	App. Alt.	Sun's Corr.	Star's Corr.
° ′	′ ″	′ ″	° ′	′ ″	′ ″	° ′	′ ″	′ ″	° ′	′ ″	′ ″
15 0	3 22	3 30	20 0	2 27	2 35	30 0	1 31	1 38	50 0	0 42	0 48
5	3 21	3 29	10	2 26	2 34	20	1 30	1 37	30	0 41	0 47
10	3 19	3 28	20	2 25	2 33	40	1 28	1 36	51 0	0 41	0 46
15	3 18	3 27	30	2 23	2 31	31 0	1 27	1 35	30	0 40	0 45
20	3 17	3 26	40	2 22	2 30	20	1 26	1 33	52 0	0 39	0 44
25	3 16	3 24	50	2 21	2 29	40	1 25	1 32	30	0 38	0 44
15 30	3 15	3 23	21 0	2 19	2 27	32 0	1 24	1 31	53 0	0 38	0 43
35	3 14	3 22	10	2 18	2 26	20	1 22	1 30	30	0 37	0 42
40	3 13	3 21	20	2 17	2 25	40	1 21	1 29	54 0	0 36	0 41
45	3 11	3 20	30	2 16	2 24	33 0	1 20	1 27	30	0 36	0 41
50	3 10	3 19	40	2 14	2 23	20	1 19	1 26	55 0	0 35	0 40
55	3 9	3 18	50	2 13	2 21	40	1 18	1 25	30	0 34	0 39
16 0	3 8	3 17	22 0	2 12	2 20	34 0	1 17	1 24	56 0	0 34	0 38
5	3 7	3 16	10	2 11	2 19	20	1 16	1 23	30	0 33	0 38
10	3 6	3 15	20	2 10	2 18	40	1 15	1 22	57 0	0 32	0 37
15	3 5	3 14	30	2 9	2 17	35 0	1 14	1 21	30	0 32	0 36
20	3 4	3 13	40	2 8	2 16	20	1 13	1 20	58 0	0 31	0 36
25	3 3	3 12	50	2 7	2 15	40	1 12	1 19	30	0 30	0 35
16 30	3 2	3 11	23 0	2 6	2 14	36 0	1 11	1 18	59 0	0 30	0 34
35	3 1	3 10	10	2 4	2 13	20	1 10	1 17	30	0 29	0 34
40	3 0	3 9	20	2 3	2 11	40	1 9	1 16	60 0	0 29	0 33
45	2 59	3 8	30	2 2	2 10	37 0	1 9	1 15	30	0 28	0 32
50	2 58	3 7	40	2 1	2 9	20	1 8	1 15	61 0	0 27	0 32
55	2 57	3 6	50	2 0	2 8	40	1 7	1 14	30	0 27	0 31
17 0	2 56	3 5	24 0	1 59	2 7	38 0	1 6	1 13	62 0	0 26	0 30
5	2 55	3 4	10	1 58	2 6	20	1 5	1 12	30	0 26	0 30
10	2 54	3 3	20	1 57	2 5	40	1 4	1 11	63 0	0 25	0 29
15	2 54	3 2	30	1 57	2 4	39 0	1 3	1 10	30	0 24	0 28
20	2 53	3 1	40	1 56	2 4	20	1 3	1 9	64 0	0 24	0 28
25	2 52	3 0	50	1 55	2 3	40	1 2	1 9	30	0 23	0 27
17 30	2 51	2 59	25 0	1 54	2 2	40 0	1 1	1 8	65 0	0 23	0 27
35	2 50	2 58	10	1 53	2 1	20	1 0	1 7	30	0 22	0 26
40	2 49	2 57	20	1 52	2 0	40	0 59	1 6	66 0	0 22	0 25
45	2 48	2 56	30	1 51	1 59	41 0	0 59	1 5	30	0 21	0 25
50	2 47	2 56	40	1 50	1 58	20	0 58	1 5	67 0	0 21	0 24
55	2 46	2 55	50	1 49	1 57	40	0 57	1 4	30	0 20	0 24
18 0	2 46	2 54	26 0	1 49	1 56	42 0	0 57	1 3	68 0	0 20	0 23
5	2 45	2 53	10	1 48	1 56	20	0 56	1 2	69 0	0 19	0 22
10	2 44	2 52	20	1 47	1 55	40	0 55	1 2	70 0	0 18	0 21
15	2 43	2 51	30	1 46	1 54	43 0	0 55	1 1	71 0	0 17	0 20
20	2 42	2 51	40	1 45	1 53	20	0 54	1 0	72 0	0 16	0 18
25	2 41	2 50	50	1 44	1 52	40	0 53	1 0	73 0	0 15	0 17
18 30	2 41	2 49	27 0	1 44	1 51	44 0	0 53	0 59	74 0	0 14	0 16
35	2 40	2 48	10	1 43	1 51	20	0 52	0 58	75 0	0 13	0 15
40	2 39	2 47	20	1 42	1 50	40	0 51	0 58	76 0	0 12	0 14
45	2 38	2 47	30	1 41	1 49	45 0	0 51	0 57	77 0	0 11	0 13
50	2 38	2 46	40	1 41	1 48	20	0 50	0 56	78 0	0 10	0 12
55	2 37	2 45	50	1 40	1 48	40	0 49	0 56	79 0	0 9	0 11
19 0	2 36	2 44	28 0	1 39	1 47	46 0	0 49	0 55	80 0	0 8	0 10
5	2 35	2 44	10	1 38	1 46	20	0 48	0 54	81 0	0 8	0 9
10	2 35	2 43	20	1 38	1 45	40	0 48	0 54	82 0	0 7	0 8
15	2 34	2 42	30	1 37	1 45	47 0	0 47	0 53	83 0	0 6	0 7
20	2 33	2 41	40	1 36	1 44	20	0 47	0 52	84 0	0 5	0 6
25	2 32	2 41	50	1 35	1 43	40	0 46	0 52	85 0	0 4	0 5
19 30	2 32	2 40	29 0	1 35	1 42	48 0	0 45	0 51	86 0	0 3	0 4
35	2 31	2 39	10	1 34	1 42	20	0 45	0 51	87 0	0 3	0 3
40	2 30	2 38	20	1 33	1 41	40	0 44	0 50	88 0	0 2	0 2
45	2 29	2 38	30	1 33	1 40	49 0	0 44	0 49	89 0	0 1	0 1
50	2 29	2 37	40	1 32	1 40	20	0 43	0 49	90 0	0 0	0 0
55	2 28	2 36	50	1 31	1 39	40	0 43	0 48			

TABLE XIV.

TO FIND LATITUDE BY REDUCTION TO THE MERIDIAN.

Natural Sines.

M.	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	M.
0	000000	017452	034899	052336	069756	087156	104528	121869	139173	156434	60
1	000291	017743	035190	052626	070047	087446	104818	122158	139461	156722	59
2	000582	018034	035481	052917	070337	087735	105107	122447	139749	157009	58
3	000873	018325	035772	053207	070627	088025	105396	122735	140037	157296	57
4	001164	018616	036062	053498	070917	088315	105686	123024	140325	157584	56
5	001454	018907	036353	053788	071207	088605	105975	123313	140613	157871	55
6	001745	019197	036644	054079	071497	088894	106264	123601	140901	158158	54
7	002036	019488	036934	054369	071788	089184	106553	123890	141189	158445	53
8	002327	019779	037225	054660	072078	089474	106843	124179	141477	158732	52
9	002618	020070	037516	054950	072368	089763	107132	124467	141765	159020	51
10	002909	020361	037806	055241	072658	090053	107421	124756	142053	159307	50
11	003200	020652	038097	055531	072948	090343	107710	125045	142341	159594	49
12	003491	020942	038388	055822	073238	090633	107999	125333	142629	159881	48
13	003782	021233	038678	056112	073528	090922	108289	125622	142917	160168	47
14	004072	021524	038969	056402	073818	091212	108578	125910	143205	160455	46
15	004363	021815	039260	056693	074108	091502	108867	126199	143493	160743	45
16	004654	022106	039550	056983	074399	091791	109156	126488	143780	161030	44
17	004945	022397	039841	057274	074689	092081	109445	126776	144068	161317	43
18	005236	022687	040132	057564	074979	092371	109734	127065	144356	161604	42
19	005527	022978	040422	057854	075269	092660	110023	127353	144644	161891	41
20	005818	023269	040713	058145	075559	092950	110313	127642	144932	162178	40
21	006109	023560	041004	058435	075849	093239	110602	127930	145220	162465	39
22	006399	023851	041294	058726	076139	093529	110891	128219	145507	162752	38
23	006690	024141	041585	059016	076429	093819	111180	128507	145795	163039	37
24	006981	024432	041876	059306	076719	094108	111469	128796	146083	163326	36
25	007272	024723	042166	059597	077009	094398	111758	129084	146371	163613	35
26	007563	025014	042457	059887	077299	094687	112047	129373	146659	163900	34
27	007854	025305	042748	060177	077589	094977	112336	129661	146946	164187	33
28	008145	025595	043038	060468	077879	095267	112625	129949	147234	164474	32
29	008436	025886	043329	060758	078169	095556	112914	130238	147522	164761	31
30	008727	026177	043619	061049	078459	095846	113203	130526	147809	165048	30
31	009017	026468	043910	061339	078749	096135	113492	130815	148097	165334	29
32	009308	026759	014201	061629	079039	096425	113781	131103	148385	165621	28
33	009599	027049	044491	061920	079329	096714	114070	131391	148672	165908	27
34	009890	027340	044782	062210	079619	097004	114359	131680	148960	166195	26
35	010181	027631	045072	062500	079909	097293	114648	131968	149248	166482	25
36	010472	027922	045363	062791	080199	097583	114937	132256	149535	166769	24
37	010763	028212	045654	063081	080489	097872	115226	132545	149823	167056	23
38	011054	028503	045944	063371	080779	098162	115515	132833	150111	167342	22
39	011344	028794	046235	063661	081069	098451	115804	133121	150398	167629	21
40	011635	029085	046525	063952	081359	098741	116093	133410	150686	167916	20
41	011926	029375	046816	064242	081649	099030	116382	133698	150973	168203	19
42	012217	029666	047106	064532	081939	099320	116671	133986	151261	168489	18
43	012508	029957	047397	064823	082228	099609	116960	134274	151548	168776	17
44	012799	030248	047688	065113	082518	099899	117249	134563	151836	169063	16
45	013090	030539	047978	065403	082808	100188	117537	134851	152123	169350	15
46	013380	030829	048269	065693	083098	100477	117826	135139	152411	169636	14
47	013671	031120	048559	065984	083388	100767	118115	135427	152698	169923	13
48	013962	031411	048850	066274	083678	101056	118404	135716	152986	170209	12
49	014253	031702	049140	066564	083968	101346	118693	136004	153273	170496	11
50	014544	031992	049431	066854	084258	101635	118982	136292	153561	170783	10
51	014835	032283	049721	067145	084547	101924	119270	136580	153848	171069	9
52	015126	032574	050012	067435	084837	102214	119559	136868	154136	171356	8
53	015416	032864	050302	067725	085127	102503	119848	137156	154423	171643	7
54	015707	033155	050593	068015	085417	102793	120137	137445	154710	171929	6
55	015998	033446	050883	068306	085707	103082	120426	137733	154998	172216	5
56	016289	033737	051174	068596	085997	103371	120714	138021	155285	172502	4
57	016580	034027	051464	068886	086286	103661	121003	138309	155572	172789	3
58	016871	034318	051755	069176	086576	103950	121292	138597	155860	173075	2
59	017162	034609	052045	069466	086866	104239	121581	138885	156147	173362	1
60	017452	034899	052336	069756	087156	104528	121869	139173	156434	173648	0
M.	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	M.

Natural Co-sines.

TABLE XIV.

TO FIND LATITUDE BY REDUCTION TO THE MERIDIAN.

Natural Sines.

M.	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	M.
0	173648	190809	207912	224951	241922	258819	275637	292372	309017	325568	60
1	173935	191095	208196	225234	242204	259100	275917	292650	309294	325843	59
2	174221	191380	208481	225518	242486	259381	276197	292928	309570	326118	58
3	174508	191666	208765	225801	242769	259662	276476	293206	309847	326393	57
4	174794	191951	209050	226085	243051	259943	276756	293484	310123	226668	56
5	175080	192237	209334	226368	243333	260224	277035	293762	310400	326943	55
6	175367	192522	209619	226651	243615	260505	277315	294040	310676	327218	54
7	175653	192807	209903	226935	243897	260785	277594	294318	310953	327493	53
8	175939	193093	210187	227218	244179	261066	277874	294596	311229	327768	52
9	176226	193378	210472	227501	244461	261347	278153	294874	311506	328042	51
10	176512	193664	210756	227784	244743	261628	278432	295152	311782	328317	50
11	176798	193949	211040	228068	245025	261908	278712	295430	312059	328592	49
12	177085	194234	211325	228351	245307	262189	278991	295708	312335	328867	48
13	177371	194520	211609	228634	245589	262470	279270	295986	312611	329141	47
14	177657	194805	211893	228917	245871	262751	279550	296264	312888	329416	46
15	177944	195090	212178	229200	246153	263031	279829	296542	313164	329691	45
16	178230	195376	212462	229484	246435	263312	280108	296819	313440	329965	44
17	178516	195661	212746	229767	246717	263592	280388	297097	313716	330240	43
18	178802	195946	213030	230050	246999	263873	280667	297375	313992	330514	42
19	179088	196231	213315	230333	247281	264154	280946	297653	314269	330789	41
20	179375	196517	213599	230616	247563	264434	281225	297930	314545	331063	40
21	179661	196802	213883	230899	247845	264715	281504	298208	314821	331338	49
22	179947	197087	214167	231182	248126	264995	281783	298486	315097	331612	38
23	180233	197372	214451	231465	248408	265276	282062	298763	315373	331887	37
24	180519	197657	214735	231748	248690	265556	282341	299041	315649	332161	36
25	180805	197942	215019	232031	248972	265837	282620	299318	315925	332435	35
26	181091	198228	215303	232314	249253	266117	282900	299596	316201	332710	34
27	181377	198513	215588	232597	249535	266397	283179	299873	316477	332984	33
28	181663	198798	215872	232880	249817	266678	283457	300151	316753	333258	32
29	181950	199083	216156	233163	250098	266958	283736	300428	317029	333533	31
30	182236	199368	216440	233445	250380	267238	284015	300706	317305	333807	30
31	182522	199653	216724	233728	250662	267519	284294	300983	317580	334081	29
32	182808	199938	217008	234011	250943	267799	284573	301261	317856	334355	28
33	183094	200223	217292	234294	251225	268079	284852	301538	318132	334629	27
34	183379	200508	217575	234577	251506	268359	285131	301815	318408	334903	26
35	183665	200793	217859	234859	251788	268640	285410	302093	318684	335178	25
36	183951	201078	218143	235142	252069	268920	285688	302370	318959	335452	24
37	184237	201363	218427	235425	252351	269200	285967	302647	319235	335726	23
38	184523	201648	218711	235708	252632	269480	286246	302924	319511	336000	22
39	184809	201933	218995	235990	252914	269760	286525	303202	319786	336274	21
40	185095	202218	219279	236273	253195	270040	286803	303479	320062	336547	20
41	185381	202502	219562	236556	253477	270320	287082	303756	320337	336821	19
42	185667	202787	219846	236838	253758	270600	287361	304033	320613	337095	18
43	185952	203072	220130	237121	254039	270880	287639	304310	320889	337369	17
44	186238	203357	220414	237403	254321	271160	287918	304587	321164	337643	16
45	186524	203642	220697	237686	254602	271440	288196	304864	321439	337917	15
46	186810	203927	220981	237968	254883	271720	288475	305141	321715	338190	14
47	187096	204211	221265	238251	255165	272000	288753	305418	321990	338464	13
48	187381	204496	221548	238533	255446	272280	289032	305695	322266	338738	12
49	187667	204781	221832	238816	255727	272560	289310	305972	322541	339012	11
50	187953	205065	222116	239098	256008	272840	289589	306249	322816	339285	10
51	188238	205350	222399	239381	256289	273120	289867	306526	323092	339559	9
52	188524	205635	222683	239663	256571	273400	290145	306803	323367	339832	8
53	188810	205920	222967	239946	256852	273679	290424	307080	323642	340106	7
54	189095	206204	223250	240228	257133	273959	290702	307357	323917	340380	6
55	189381	206489	223534	240510	257414	274239	290981	307633	324193	340653	5
56	189667	206773	223817	240793	257695	274519	291259	307910	324468	340927	4
57	189952	207058	224101	241075	257976	274798	291537	308187	324743	341200	3
58	190238	207343	224384	241357	258257	275078	291815	308464	325018	341473	2
59	190523	207627	224668	241640	258538	275358	292094	308740	325293	341747	1
60	190809	207912	224951	241922	258819	275637	292372	309017	325568	342020	0
M.	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	M.

Natural Co-sines.

TABLE XIV.

TO FIND LATITUDE BY REDUCTION TO THE MERIDIAN.

Natural Sines.

M.	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	M.
0	342020	358368	374607	390731	406737	422618	438371	453990	469472	484810	60
1	342293	358640	374876	390999	407002	422882	438633	454250	469728	485064	59
2	342567	358911	375146	391267	407268	423145	438894	454509	469985	485318	58
3	342840	359183	375416	391534	407534	423409	439155	454768	470242	485573	57
4	343113	359454	375685	391802	407799	423673	439417	455027	470499	485827	56
5	343387	359725	375955	392070	408065	423936	439678	455286	470755	486081	55
6	343660	359997	376224	392337	408330	424199	439939	455545	471012	486335	54
7	343933	360268	376494	392605	408596	424463	440200	455804	471268	486590	53
8	344206	360540	376763	392872	408861	424726	440462	456063	471525	486844	52
9	344479	360811	377033	393140	409127	424990	440723	456322	471782	487098	51
10	344752	361082	377302	393407	409392	425253	440984	456580	472038	487352	50
11	345025	361353	377571	393675	409658	425516	441245	456839	472294	487606	49
12	345298	361625	377841	393942	409923	425779	441506	457098	472551	487860	48
13	345571	361896	378110	394209	410188	426042	441767	457357	472807	488114	47
14	345844	362167	378379	394477	410454	426306	442028	457615	473063	488367	46
15	346117	362438	378649	394744	410719	426569	442289	457874	473320	488621	45
16	346390	362709	378918	395011	410984	426832	442550	458133	473576	488875	44
17	346663	362980	379187	395278	411249	427095	442810	458391	473832	489129	43
18	346936	363251	379456	395546	411514	427358	443071	458650	474088	489382	42
19	347208	363522	379725	395813	411779	427621	443332	458908	474344	489636	41
20	347481	363793	379994	396080	412045	427884	443593	459166	474600	489890	40
21	347754	364064	380263	396347	412310	428147	443853	459425	474856	490143	39
22	348027	364335	380532	396614	412575	428410	444114	459683	475112	490397	38
23	348299	364606	380801	396881	412840	428672	444375	459942	475368	490650	37
24	348572	364877	381070	397148	413104	428935	444635	460200	475624	490904	36
25	348845	365148	381339	397415	413369	429198	444896	460458	475880	491157	35
26	349117	365418	381608	397682	413634	429461	445156	460716	476136	491411	34
27	349390	365689	381877	397949	413899	429723	445417	460974	476392	491664	33
28	349662	365960	382146	398215	414164	429986	445677	461232	476647	491917	32
29	349935	366231	382415	398482	414429	430249	445937	461491	476903	492170	31
30	350207	366501	382683	398749	414693	430511	446198	461749	477159	492424	30
31	350480	366772	382952	399016	414958	430774	446458	462007	477414	492677	29
32	350752	367042	383221	399283	415223	431036	446718	462265	477670	492930	28
33	351025	367313	383490	399549	415487	431299	446979	462523	477925	493183	27
34	351297	367584	383758	399816	415752	431561	447239	462780	478181	493436	26
35	351569	367854	384027	400082	416016	431823	447499	463038	478436	493689	25
36	351842	368125	384295	400349	416281	432086	447759	463296	478692	493942	24
37	352114	368395	384564	400616	416545	432348	448019	463554	478947	494195	23
38	352386	368665	384832	400882	416810	432610	448279	463812	479203	494448	22
39	352658	368936	385101	401149	417074	432873	448539	464069	479458	494700	21
40	352931	369206	385369	401415	417338	433135	448799	464327	479713	494953	20
41	353203	369476	385638	401681	417603	433397	449059	464584	479968	495206	19
42	353475	369747	385906	401948	417867	433659	449319	464842	480223	495459	18
43	353747	370017	386174	402214	418131	433921	449579	465100	480479	495711	17
44	354019	370287	386443	402480	418396	434183	449839	465357	480734	495964	16
45	354291	370557	386711	402747	418660	434445	450098	465615	480989	496217	15
46	354563	370828	386979	403013	418924	434707	450358	465872	481244	496469	14
47	354835	371098	387247	403279	419188	434969	450618	466129	481499	496722	13
48	355107	371368	387516	403545	419452	435231	450878	466387	481754	496974	12
49	355379	371638	387784	403811	419716	435493	451137	466644	482009	497226	11
50	355651	371908	388052	404078	419980	435755	451397	466901	482263	497479	10
51	355923	372178	388320	404344	420244	436017	451656	467158	482518	497731	9
52	356194	372448	388588	404610	420508	436278	451916	467416	482773	497983	8
53	356466	372718	388856	404876	420772	436540	452175	467673	483028	498236	7
54	356738	372988	389124	405142	421036	436802	452435	467930	483282	498488	6
55	357010	373258	389392	405408	421300	437063	452694	468187	483537	498740	5
56	357281	373528	389660	405673	421563	437325	452953	468441	483792	498992	4
57	357553	373797	389928	405939	421827	437587	453213	468701	484046	499244	3
58	357825	374067	390196	406205	422091	437848	453472	468958	484301	499496	2
59	358096	374337	390463	406471	422355	438110	453731	469215	484555	499748	1
60	358368	374607	390731	406737	422618	438371	453990	469472	484810	500000	0
M.	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	M.

Natural Co-sines.

TABLE XIV.

TO FIND LATITUDE BY REDUCTION TO THE MERIDIAN.

Natural Sines.

M.	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	M.
0	500000	515038	529919	544639	559193	573576	587785	601815	615661	629320	60
1	500252	515287	530166	544883	559434	573815	588021	602047	615891	629546	59
2	500504	515537	530413	545127	559675	574053	588256	602280	616120	629772	58
3	500756	515786	530659	545371	559916	574291	588491	602512	616349	629998	57
4	501007	516035	530906	545615	560157	574529	588726	602744	616578	630224	56
5	501259	516284	531152	545858	560398	574767	588961	602976	616807	630450	55
6	501511	516533	531399	546102	560639	575005	589196	603208	617036	630676	54
7	501762	516782	531645	546346	560880	575243	589431	603440	617265	630902	53
8	502014	517031	531891	546589	561121	575481	589666	603672	617494	631127	52
9	502266	517280	532138	546833	561361	575719	589901	603904	617722	631353	51
10	502517	517529	532384	547076	561602	575957	590136	604136	617951	631578	50
11	502769	517778	532630	547320	561843	576195	590371	604367	618180	631804	49
12	503020	518027	532876	547563	562083	576432	590606	604599	618408	632029	48
13	503271	518276	533122	547807	562324	576670	590840	604831	618637	632255	47
14	503523	518525	533368	548050	562564	576908	591075	605062	618865	632480	46
15	503774	518773	533615	548293	562805	577145	591310	605294	619094	632705	45
16	504025	519022	533861	548536	563045	577383	591544	605526	619322	632931	44
17	504276	519271	534106	548780	563286	577620	591779	605757	619551	633156	43
18	504528	519519	534352	549023	563526	577858	592013	605988	619779	633381	42
19	504779	519768	534598	549266	563766	578095	592248	606220	620007	633606	41
20	505030	520016	534844	549509	564007	578332	592482	606451	620235	633831	40
21	505281	520265	535090	549752	564247	578570	592716	606682	620464	634056	39
22	505532	520513	535335	549995	564487	578807	592951	606914	620692	634281	38
23	505783	520761	535581	550238	564727	579044	593185	607145	620920	634506	37
24	506034	521010	535827	550481	564967	579281	593419	607376	621148	634731	36
25	506285	521258	536072	550724	565207	579518	593653	607607	621376	634955	35
26	506535	521506	536318	550966	565447	579755	593887	607838	621604	635180	34
27	506786	521754	536563	551209	565687	579992	594121	608069	621831	635405	33
28	507037	522002	536809	551452	565927	580229	594355	608300	622059	635629	32
29	507288	522251	537054	551694	566166	580466	594589	608531	622287	635854	31
30	507538	522499	537300	551937	566406	580703	594823	608761	622515	636078	30
31	507789	522747	537545	552180	566646	580940	595057	608992	622742	636303	29
32	508040	522995	537790	552422	566886	581176	595290	609223	622970	636527	28
33	508290	523242	538035	552664	567125	581413	595524	609454	623197	636751	27
34	508541	523490	538281	552907	567365	581650	595758	609684	623425	636976	26
35	508791	523738	538526	553149	567604	581886	595991	609915	623652	637200	25
36	509041	523986	538771	553392	567844	582123	596225	610145	623880	637424	24
37	509292	524234	539016	553634	568083	582359	596458	610376	624107	637648	23
38	509542	524481	539261	553876	568323	582596	596692	610606	624334	637872	22
39	509792	521729	539506	554118	568562	582832	596925	610836	624561	638096	21
40	510043	524977	539751	554360	568801	583069	597159	611067	624789	638320	20
41	510293	525224	539996	554602	569040	583305	597392	611297	625016	638544	19
42	510543	525472	540240	554844	569280	583541	597625	611527	625243	638768	18
43	510793	525719	540485	555086	569519	583777	597858	611757	625470	638992	17
44	511043	525967	540730	555328	569758	584014	598092	611987	625697	639215	16
45	511293	526214	540974	555570	569997	584250	598325	612217	525923	639439	15
46	511543	526461	541219	555812	570236	584486	598558	612447	626150	639663	14
47	511793	526709	541464	556054	570475	584722	598791	612677	626377	639886	13
48	512043	526956	541708	556296	570714	584958	599024	612907	626604	640110	12
49	512293	527203	541953	556537	570952	585194	599256	613137	626830	640333	11
50	512543	527450	542197	556779	571191	585429	599489	613367	627057	640557	10
51	512792	527697	542242	557021	571430	585665	599722	613596	627284	640780	9
52	513042	527944	542686	557262	571669	585901	599955	613826	627510	641003	8
53	513292	528191	542930	557504	571907	586137	600188	614056	627737	641226	7
54	513541	528438	543174	557745	572146	586372	600420	614285	627963	641450	6
55	513791	528685	513419	557987	572384	586608	600653	614515	628189	641673	5
56	514040	528932	543663	558228	572623	586844	600885	614744	628416	641896	4
57	514290	529179	543907	558469	572861	587079	601118	614974	628642	642119	3
58	514539	529426	544151	558710	573100	587314	601350	615203	628868	642342	2
59	514789	529673	544395	558952	573338	587550	601583	615432	629094	642565	1
60	515038	529919	544639	559193	573576	587785	601815	615661	629320	642788	0
M.	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	M.

Natural Co-sines.

TABLE XIV.

TO FIND LATITUDE BY REDUCTION TO THE MERIDIAN.

Natural Sines.

M.	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	M.
0	642788	656059	669131	681998	694658	707107	719340	731354	743145	754710	60
1	643010	656279	669347	682211	694868	707312	719542	731552	743339	754900	59
2	643233	656498	669563	682424	695077	707518	719744	731750	743531	755091	58
3	643456	656717	669779	682636	695286	707723	719946	731949	743728	755282	57
4	643679	656937	669995	682849	695495	707929	720148	732147	743923	755472	56
5	643901	657156	670211	683061	695704	708134	720349	732345	744117	755663	55
6	644124	657375	670427	683274	695913	708340	720551	732543	744312	755853	54
7	644346	657594	670642	683486	696122	708545	720753	732741	744506	756044	53
8	644569	657814	670858	683698	696330	708750	720954	732939	744700	756234	52
9	644791	658033	671074	683911	696539	708956	721156	733137	744894	756425	51
10	645013	658252	671289	684123	696748	709161	721357	733334	745088	756615	50
11	645236	658471	671505	684335	696957	709366	721559	733532	745282	756805	49
12	645458	658689	671721	684547	697165	709571	721760	733730	745476	756995	48
13	645680	658908	671936	684759	697374	709776	721962	733927	745670	757185	47
14	645902	659127	672151	684971	697582	709981	722163	734125	745864	757375	46
15	646124	659346	672367	685183	697790	710185	722364	734323	746057	757565	45
16	646346	659565	672582	685395	687999	710390	722565	734520	746251	757755	44
17	646568	659783	672797	685607	698207	710595	722766	734717	746445	757945	43
18	646790	660002	673013	685818	698415	710799	722967	734915	746638	758134	42
19	647012	660220	673228	686030	698623	711004	723168	735112	746832	758324	41
20	647233	660439	673443	686242	698832	711209	723369	735309	747025	758514	40
21	647455	660657	673658	686453	699040	711413	723570	735506	747218	758703	39
22	647677	660875	673873	686665	699248	711617	723771	735703	747412	758893	38
23	647898	661094	674088	686876	699455	711822	723971	735900	747605	759082	37
24	648120	661312	674302	687088	699663	712026	724172	736097	747798	759271	36
25	648341	661530	674517	687299	699871	712230	724372	736294	747991	759461	35
26	648563	661748	674732	687510	700079	712434	724573	736491	748184	759650	34
27	648784	661966	674947	687721	700287	712639	724773	736687	748377	759839	33
28	649006	662184	675161	687932	700494	712843	724974	736884	748570	760028	32
29	649227	662402	675376	688144	700702	713047	725174	737081	748763	760217	31
30	649448	662620	675590	688355	700909	713250	725374	737277	748956	760106	30
31	649669	662838	675805	688566	701117	713454	725575	737474	749148	760595	29
32	649890	663056	676019	688776	701324	713658	725775	737670	749341	760784	28
33	650111	663273	676233	688987	701531	713862	725975	737867	749534	760972	27
34	650332	663491	676448	689198	701739	714066	726175	738063	749726	761161	26
35	650553	663709	676662	689409	701946	714269	726375	738259	749919	761350	25
36	650774	663926	676876	689620	702153	714473	726575	738155	750111	761538	24
37	650995	664144	677090	689830	702360	714676	726775	738651	750303	761727	23
38	651216	664361	677304	690041	702567	714880	726974	738848	750196	761915	22
39	651437	664579	677518	690251	702774	715083	727174	739042	750688	762104	21
40	651657	664796	677732	690462	702981	715286	727374	739239	750880	762292	20
41	651878	665013	677946	690672	703188	715490	727573	739435	751072	762480	19
42	652098	665230	678160	690882	703395	715693	727773	739631	751264	762668	18
43	652319	665448	678373	691093	703601	715896	727972	739827	751456	762856	17
44	652539	665665	678587	691303	703808	716099	728172	740023	751648	763044	16
45	652760	665882	678801	691513	704015	716302	728371	740218	751840	763232	15
46	652980	666099	679014	691723	704221	716505	728570	740414	752032	763420	14
47	653200	666316	679228	691933	704428	716708	728769	740609	752223	763608	13
48	653421	666532	679441	692143	704634	716911	728969	740805	752415	763796	12
49	653641	666749	679655	692353	704841	717113	729168	741000	752606	763984	11
50	653861	666966	679868	692563	705047	717316	729367	741195	752798	764171	10
51	654081	667183	680081	692773	705253	717519	729566	741391	752989	764359	9
52	654301	667399	680295	692983	705459	717721	729765	741586	753181	764547	8
53	654521	667616	680508	693192	705665	717924	729963	741781	753372	764734	7
54	654741	667833	680721	693402	705872	718126	730162	741976	753563	764921	6
55	654961	668049	680934	693611	706078	718329	730361	742171	753755	765109	5
56	655180	668265	681147	693821	706284	718531	730560	742366	753946	765296	4
57	655400	668482	681360	694030	706489	718733	730758	742561	754137	765483	3
58	655620	668698	681573	694240	706695	718936	730957	742755	754328	765670	2
59	655839	668914	681786	694449	706901	719138	731155	742950	754519	765857	1
60	656059	669131	681998	694658	707107	719340	731354	743145	754710	766044	0
M.	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	M.

Natural Co-sines.

TABLE XIV.

TO FIND LATITUDE BY REDUCTION TO THE MERIDIAN.

Natural Sines.

M.	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	M.
0	766044	777146	788011	798636	809017	819152	829038	838671	848048	857167	60
1	766231	777329	788190	798811	809188	819319	829200	838829	848202	857317	59
2	766418	777512	788369	798985	809359	819486	829363	838987	848356	857467	58
3	766605	777695	788548	799100	809530	819652	829525	839146	848510	857616	57
4	766792	777878	788727	799335	809700	819819	829688	839304	848664	857766	56
5	766979	778060	788905	799510	809881	819985	829850	839462	848818	857915	55
6	767165	778243	789084	799685	810042	820152	830012	839620	848972	858065	54
7	767352	778426	789263	799859	810212	820318	830174	839778	849125	858214	53
8	767538	778608	789441	800034	810383	820485	830337	839936	849279	858364	52
9	767725	778791	789620	800208	810553	820651	830499	840094	849433	858513	51
10	767911	778973	789798	800383	810723	820817	830661	840251	849586	858662	50
11	768097	779156	789977	800557	810894	820983	830823	840409	849739	858811	49
12	768284	779338	790155	800731	811064	821149	830984	840567	849893	858960	48
13	768470	779520	790333	800906	811234	821315	831146	840724	850040	859109	47
14	768656	779702	790511	801080	811404	821481	831308	840882	850199	859258	46
15	768842	779884	790690	801254	811574	821647	831470	841039	850352	859406	45
16	769028	780067	790868	801428	811744	821813	831631	841196	850505	859555	44
17	769214	780249	791046	801602	811914	821978	831793	841354	850658	859704	43
18	769400	780430	791224	801776	812084	822144	831954	841511	850811	859852	42
19	769585	780612	791401	801949	812253	822310	832115	841668	850964	860001	41
20	769771	780794	791579	802123	812423	822475	832277	841825	851117	860149	40
21	769957	780976	791757	802297	812592	822641	832438	841982	851269	860297	39
22	770142	781157	791935	802470	812762	822806	832599	842139	851422	860446	38
23	770328	781339	792112	802644	812931	822971	832760	842296	851575	860594	37
24	770513	781520	792290	802817	813101	823136	832921	842452	851727	860742	36
25	770699	781702	792467	802991	813270	823302	833082	842609	851879	860890	35
26	770884	781883	792644	803164	813439	823467	833243	842766	852032	861038	34
27	771069	782065	792822	803337	813608	823632	833404	842922	852184	861186	33
28	771254	782246	792999	803511	813778	823797	833565	843079	852336	861334	32
29	771440	782427	793176	803684	813947	823961	833725	843235	852488	861481	31
30	771625	782608	793353	803857	814116	824126	833886	843391	852640	861629	30
31	771810	782789	793530	804030	814284	824291	834046	843548	852792	861777	29
32	771995	782970	793707	804203	814453	824456	834207	843704	852944	861924	28
33	772179	783151	793881	804376	814622	824620	834367	843860	853096	862072	27
34	772364	783332	794061	804548	814791	824785	834527	844016	853248	862219	26
35	772549	783513	794238	804721	814959	824949	834688	844172	853399	862366	25
36	772734	783693	794415	804894	815128	825113	834848	844328	853551	862514	24
37	772918	783874	794591	805066	815296	825278	835008	844484	853702	862661	23
38	773103	784055	794768	805239	815465	825442	835168	844640	853854	862808	22
39	773287	784235	794944	805411	815633	825606	835328	844795	854005	862955	21
40	773472	784416	795121	805584	815801	825770	835488	844951	854156	863102	20
41	773656	784596	795297	805756	815969	825934	835648	845106	854308	863249	19
42	773840	784776	795473	805928	816138	826098	835807	845262	854459	863396	18
43	774024	784957	795650	806100	816306	826262	835967	845417	854610	863542	17
44	774209	785137	795826	806273	816474	826426	836127	845573	854761	863689	16
45	774393	785317	796002	806445	816642	826590	836286	845728	854912	863836	15
46	774577	785497	796178	806617	816809	826753	836446	845883	855063	863982	14
47	774761	785677	796354	806788	816977	826917	836605	846038	855214	864128	13
48	774944	785857	796530	806960	817145	827081	836764	846193	855364	864275	12
49	775128	786037	796706	807132	817313	827244	836924	846348	855515	864421	11
50	775312	786217	796882	807304	817480	827407	837083	846503	855665	864567	10
51	775496	786396	797057	807475	817648	827571	837242	846658	855816	864713	9
52	775679	786576	797233	807647	817815	827734	837401	846813	855966	864860	8
53	775863	786756	797408	807818	817982	827897	837560	846967	856117	865006	7
54	776046	786935	797584	807990	818150	828060	837719	847122	856267	865151	6
55	776230	787114	797759	808161	818317	828223	837878	847277	856417	865297	5
56	776413	787294	797935	808333	818484	828386	838036	847431	856567	865443	4
57	776596	787473	798110	808504	818651	828549	838195	847585	856718	865589	3
58	776780	787652	798285	808675	818818	828712	838354	847740	856868	865734	2
59	776963	787832	798460	808846	818985	828875	838512	847894	857017	865880	1
60	777146	788011	798636	809017	819152	829038	838671	848048	857167	866025	0
M.	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	M.

Natural Co-sines.

TABLE XIV.

TO FIND LATITUDE BY REDUCTION TO THE MERIDIAN.

Natural Sines.

M.	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	M.
0	866025	874620	882948	891007	898794	906308	913545	920505	927184	933580	60
1	866171	874761	883084	891139	898922	906431	913664	920618	927293	933685	59
2	866316	874902	883221	891270	899049	906554	913782	920732	927402	933789	58
3	866461	875042	883357	891402	899176	906676	913900	920846	927510	933893	57
4	866607	875183	883492	891534	899304	906799	914018	920959	927619	933997	56
5	866752	875324	883629	891666	899431	906922	914136	921072	927728	934101	55
6	869897	875465	883766	891798	899558	907044	914254	921185	927836	934204	54
7	867042	875605	883902	891929	899685	907166	914372	921299	927945	934308	53
8	867187	875746	884038	892061	899812	907289	914490	921412	928053	934412	52
9	867331	875886	884174	892192	899939	907411	914607	921525	928161	934515	51
10	867476	876026	884309	892323	900065	907533	914725	921638	928270	934619	50
11	867621	876167	884445	892455	900192	907655	914842	921750	928378	934722	49
12	867765	876307	884581	892586	900319	907777	914960	921863	928486	934826	48
13	867910	876447	884717	892717	900445	907899	915077	921976	928594	934929	47
14	868054	876587	884852	892848	900572	908021	915194	922088	928702	935032	46
15	868199	876727	884988	892979	900698	908143	915311	922201	928810	935135	45
16	868343	876867	885123	893110	900825	908265	915429	922313	928917	935238	44
17	868487	877006	885258	893241	900951	908387	915546	922426	929025	935341	43
18	868632	877146	885394	893371	901077	908508	915663	922538	929133	935444	42
19	868776	877286	885529	893502	901203	908630	915779	922650	929240	935547	41
20	868920	877425	885664	893633	901329	908751	915896	922762	929348	935650	40
21	869064	877565	885799	893763	901455	908872	916013	922874	929455	935752	39
22	869207	877704	885934	893894	901581	908994	916130	922986	929562	935855	38
23	869351	877844	886069	894024	901707	909115	916246	923098	929669	935957	37
24	869495	877983	886204	894154	901833	909236	916363	923210	929776	936060	36
25	869639	878122	886338	894284	901958	909357	916479	923322	929884	936162	35
26	869782	878261	886473	894415	902084	909478	916595	923434	929990	936264	34
27	869926	878400	886608	894545	902209	909599	916712	923545	930097	936366	33
28	870069	878539	886742	894675	902335	909720	916828	923657	930204	936468	32
29	870212	878678	886876	894805	902460	909841	916944	923768	930311	936570	31
30	870356	878817	887011	894934	902585	909961	917060	923880	930418	936672	30
31	870499	878956	887145	895064	902710	910082	917176	923991	930524	936774	29
32	870642	879095	887279	895194	902836	910202	917292	924102	930631	936876	28
33	870785	879233	887413	895323	902961	910323	917408	924213	930737	936977	27
34	870928	879372	887548	895453	903086	910443	917523	924324	930843	937079	26
35	871071	879510	887681	895582	903210	910563	917639	924435	930950	937181	25
36	871214	879649	887815	895712	903335	910684	917755	924546	931056	937282	24
37	871357	879787	887949	895841	903460	910804	917870	924657	931162	937383	23
38	871499	879925	888083	895970	903585	910924	917986	924768	931268	937485	22
39	871642	880063	888217	896099	903709	911044	918101	924878	931374	937586	21
40	871784	880201	888350	896229	903834	911164	918216	924989	931480	937687	20
41	871927	880339	888484	896358	903958	911284	918331	925099	931586	937788	19
42	872069	880477	888617	896486	904083	911403	918446	925210	931691	937889	18
43	872212	880615	888751	896615	904207	911523	918561	925320	931797	937990	17
44	872354	880753	888884	896744	904331	911643	918676	925430	931902	938091	16
45	872496	880891	889017	896873	904455	911762	918791	925541	932008	938191	15
46	872638	881028	889150	897001	904579	911881	918906	925651	932113	938292	14
47	872780	881166	889283	897130	904703	912001	919021	925761	932219	938393	13
48	872922	881303	889416	897258	904827	912120	919135	925871	932324	938493	12
49	873064	881441	889549	897387	904951	912239	919250	925980	932429	938593	11
50	873206	881578	889682	897515	905075	912358	919364	926090	932534	938694	10
51	873347	881716	889815	897643	905198	912477	919479	926200	932639	938794	9
52	873489	881853	889948	897771	905322	912596	919593	926310	932744	938894	8
53	873631	881990	890080	897900	905445	912715	919707	926419	932849	938994	7
54	873772	882127	890213	898028	905569	912834	919821	926529	932954	939094	6
55	873914	882264	890345	898156	905692	912953	919936	926638	933058	939194	5
56	874055	882401	890478	898283	905815	913072	920050	926747	933163	939294	4
57	874196	882538	890610	898411	905939	913190	920164	926857	933267	939394	3
58	874338	882674	890742	898539	906062	913309	920277	926966	933372	939493	2
59	874479	882811	890874	898666	906185	913427	920391	927075	933476	939593	1
60	874620	882948	891007	898794	906308	913545	920505	927184	933580	939693	0
M.	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	M.

Natural Co-sines.

TABLE XIV.

TO FIND LATITUDE BY REDUCTION TO THE MERIDIAN.

Natural Sines.

M.	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	M.
0	939693	945519	951057	956305	961262	965926	970296	974370	978148	981627	60
1	939792	945613	951146	956390	961342	966001	970366	974435	978208	981683	59
2	939891	945708	951236	956475	961422	966076	970436	974501	978268	981738	58
3	939991	945802	951326	956560	961502	966151	970506	974566	978329	981793	57
4	940090	945897	951415	956644	961582	966226	970577	974631	978389	981849	56
5	940189	945991	951505	956729	961662	966301	970647	974696	978449	981904	55
6	940288	946085	951594	956814	961741	966376	970716	974761	978509	981959	54
7	940387	946180	951684	956898	961821	966451	970786	974826	978569	982014	53
8	940486	946274	951773	956983	961901	966526	970856	974891	978629	982069	52
9	940585	946368	951862	957067	961980	966600	970926	974956	978689	982123	51
10	940684	946462	951951	957151	962059	966675	970995	975020	978748	982178	50
11	940782	946555	952040	957235	962139	966749	971065	975085	978808	982233	49
12	940881	946649	952129	957319	962218	966823	971134	975149	978867	982287	48
13	940979	946743	952218	957401	962297	966898	971204	975214	978927	982342	47
14	941078	946837	952307	957487	962376	966972	971273	975278	978986	982396	46
15	941176	946930	952396	957571	962455	967046	971342	975342	979045	982450	45
16	941274	947024	952484	957655	962534	967120	971411	975406	979105	982505	44
17	941372	947117	952573	957739	962613	967194	971480	975471	979164	982559	43
18	941471	947210	952661	957822	962692	967268	971549	975535	979223	982613	42
19	941569	947304	952750	957906	962770	967342	971618	975598	979282	982667	41
20	941666	947397	952838	957990	962849	967415	971687	975662	979341	982721	40
21	941764	947490	952926	958073	962928	967489	971755	975726	979399	982774	39
22	941862	947583	953015	958156	963006	967562	971824	975790	979458	982828	38
23	941960	947676	953103	958239	963084	967636	971893	975853	979517	982882	37
24	942057	947768	953191	958323	963163	967709	971961	975917	979575	982935	36
25	942155	947861	953279	958406	963241	967782	972030	975980	979634	982989	35
26	942252	947954	953366	958489	963319	957856	972098	976044	979692	983042	34
27	942350	948046	953454	958572	963397	967929	972166	976107	979750	983096	33
28	942447	948139	953542	958654	963475	968002	972234	976170	979809	983149	32
29	942544	948231	953629	958737	963553	968075	972302	976233	979867	983202	31
30	942641	948324	953717	958820	963630	968148	972370	976296	979925	983255	30
31	942739	948416	953804	958902	963708	968220	972438	976359	979983	983308	29
32	942836	948508	953892	958985	963786	968293	972506	976422	980041	983361	28
33	942932	948600	953979	959067	963863	968366	972573	976485	980098	983414	27
34	943029	948692	954066	959150	963941	968438	972641	976547	980156	983466	26
35	943126	948784	954153	959232	964018	968511	972708	976610	980214	983519	25
36	943223	948876	944240	959314	964095	968583	972776	976672	980271	983571	24
37	943319	948968	954327	959396	964173	968656	972843	976735	980329	983624	23
38	943416	949059	954414	959478	964250	968728	972911	976797	980386	983676	22
39	943512	949151	954501	959560	964327	968800	972978	976859	980443	983729	21
40	943609	949243	954588	959642	964404	968872	973045	976921	980500	983781	20
41	943705	949334	954674	959724	964481	968944	973112	976984	980558	983833	19
42	943801	949425	954761	959805	964557	969016	973179	977046	980615	983885	18
43	943897	949517	954847	959887	964634	969088	973246	977108	980672	983937	17
44	943993	949608	954934	959968	964711	969159	973313	977169	980728	983989	16
45	944089	949699	955020	960050	964787	969231	973379	977231	980785	984041	15
46	944185	949790	955106	960131	964864	969302	973446	977293	980842	984092	14
47	944281	949881	955192	960212	964940	969374	973512	977354	980899	984144	13
48	944376	949972	955278	960294	965016	969445	973579	977416	980955	984196	12
49	944472	950063	955364	960375	965093	969517	973645	977477	981012	984247	11
50	944568	950154	955450	960456	965169	969588	973712	977539	981068	984298	10
51	944663	950244	955536	960537	965245	969659	973778	977600	981124	984350	9
52	944758	950335	955622	960618	965321	969730	973844	977661	981181	984401	8
53	944854	950425	955707	960698	965397	969801	973910	977722	981237	984452	7
54	944949	950516	955793	960779	965473	969872	973976	977783	981293	984503	6
55	945044	950606	955879	960860	965548	969943	974042	977844	981349	984554	5
56	945139	950696	955964	960940	965624	970014	974108	977905	981405	984605	4
57	945234	950786	956049	961021	965700	970084	974173	977966	981460	984656	3
58	945329	950877	956134	961101	965775	970155	974239	978026	981516	984707	2
59	945424	950967	956220	961181	965850	970225	974305	978087	981572	984757	1
60	945519	951057	956305	961262	965926	970296	974370	978148	981627	984808	0
M.	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	M.

Natural Co-sines.

TABLE XIV.

TO FIND LATITUDE BY REDUCTION TO THE MERIDIAN.

Natural Sines.

M.	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	M.
0	984808	987688	990268	992546	994522	996195	997564	998630	999391	999848	60
1	984858	987734	990309	992582	994552	996220	997584	998645	999401	999853	59
2	984909	987779	990349	992617	994583	996245	997604	998660	999411	999858	58
3	984959	987824	990389	992652	994613	996270	997625	998675	999421	999863	57
4	985009	987870	990429	992687	994643	996295	997645	998690	999431	999867	56
5	985059	987915	990469	992722	994673	996320	997664	998705	999441	999872	55
6	985109	987960	990509	992757	994703	996345	997684	998719	999450	999877	54
7	985159	988005	990549	992792	994733	996370	997704	998734	999460	999881	53
8	985209	988050	990589	992827	994762	996395	997724	998749	999469	999886	52
9	985259	988094	990629	992862	994792	996419	997743	998763	999479	999890	51
10	985309	988139	990669	992896	994822	996444	997763	998778	999488	999894	50
11	985358	988184	990708	992931	994851	996468	997782	998792	999497	999898	49
12	985408	988228	990748	992966	994881	996493	997801	998806	999507	999903	48
13	985457	988273	990787	993000	994910	996517	997821	998820	999516	999907	47
14	985507	988317	990827	993034	984939	996541	997840	998834	999525	999910	46
15	985556	988362	990866	993086	994969	996565	997859	998848	999534	999914	45
16	985605	988406	990905	993103	994998	996589	997878	998862	999542	999918	44
17	985654	988450	990944	993137	995027	996614	997897	998876	999551	999922	43
18	985703	988494	990983	993171	995056	996637	997916	998890	999560	999925	42
19	985752	988538	991022	993205	995084	996661	997934	998904	999568	999929	41
20	985801	988582	991061	993238	995113	996685	997953	998917	999577	999932	40
21	985850	988626	991100	993272	995142	996709	997972	998931	999585	999936	39
22	985899	988669	991138	993306	995170	996732	997990	998944	999594	999939	38
23	985947	988713	991177	993339	995199	996756	998008	998957	999602	999942	37
24	985996	988756	991216	993373	995227	996779	998027	998971	999610	999945	36
25	986045	988800	991254	993406	995256	996802	998045	998984	999618	999948	35
26	986093	988843	991292	993439	995284	996825	998063	998997	899626	999951	34
27	986141	988886	991331	993473	995312	996848	998081	999010	999634	999954	33
28	986189	988930	991369	993506	995340	996872	998099	999023	999642	999957	32
29	986238	988973	991407	993539	995368	996894	998117	999035	999650	999959	31
30	986286	989016	991445	993572	995396	996917	998135	999048	999657	999962	30
31	986334	989059	991483	993605	995424	996940	998153	999061	999665	999964	29
32	986381	989102	991521	993638	995452	996963	998170	999073	999672	999967	28
33	986429	989145	991558	993670	995479	996985	998188	999086	999680	999969	27
34	986477	989187	991596	993703	995507	997008	998205	999098	999387	999971	26
35	986525	989230	991634	993735	995535	997030	998223	999111	999694	999974	25
36	986572	989272	991671	993768	995562	997053	998240	999123	999701	999976	24
37	986620	989315	991709	993800	995589	997075	998257	999135	999709	999978	23
38	986667	989357	991746	993833	995617	997097	998274	999147	999716	999980	22
39	986714	989399	991783	993865	995644	997119	998291	999159	999722	999981	21
40	986762	989442	991820	993897	995671	997141	998308	999171	999729	999983	20
41	986809	989484	991857	993929	995698	997163	998325	999183	999736	999985	19
42	986856	989526	991894	993961	995725	997185	998342	999194	999743	999986	18
43	986903	989568	991931	993993	995752	997207	998359	999206	999749	999988	17
44	986950	989610	991968	994025	995778	997229	998375	999218	999756	999989	16
45	986996	989651	992005	994056	995805	997250	998392	999229	999762	999990	15
46	987043	989693	992042	994088	995832	997272	998408	999240	999768	999992	14
47	987090	989735	992078	994120	995858	997293	998425	999252	999775	999993	13
48	987136	989776	992115	994151	995884	997314	998441	999263	999781	999994	12
49	987183	989818	992151	994182	995911	997336	998457	999274	999787	999995	11
50	987229	989859	992187	994214	995937	997357	998473	999285	999793	999996	10
51	987275	989900	992224	994245	995963	997378	998489	999296	999799	999997	9
52	987322	989942	992260	994276	995989	997399	998505	999307	999804	999997	8
53	987368	989983	992296	994307	996015	997420	998521	999318	999810	999998	7
54	987414	990024	992332	994338	996041	997441	998537	999328	999816	999998	6
55	987460	990065	992368	994369	996067	997462	998552	999339	999821	999999	5
56	987506	990105	992404	994400	996093	997482	998568	999350	999827	999999	4
57	987551	990146	992439	994430	996118	997503	998583	999360	999832	1000000	3
58	987597	990187	992475	994461	996144	997523	998599	999370	999837	1000000	2
59	987643	990228	992511	994491	996169	997544	998614	999381	999843	1000000	1
60	987688	990268	992546	994522	996195	997564	998630	999391	999848	1000000	0
M.	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	M.

Natural Co-sines.

TABLE XV.

FOR FINDING THE DISTANCE OF TERRESTRIAL OBJECTS AT SEA.

Height in Feet.	Distance in Miles.	Height in Feet.	Distance in Miles.	Height in Feet.	Distance in Miles.
1	1.15	85	10.6	660	29.5
2	1.62	90	10.9	680	30.0
3	1.99	95	11.2	700	30.4
4	2.30	100	11.5	720	30.8
5	2.57	105	11.8	740	31.2
6	2.81	110	12.1	760	31.7
7	3.04	115	12.3	780	32.1
8	3.25	120	12.6	800	32.5
9	3.45	125	12.8	820	32.9
10	3.63	130	13 1	840	33.3
11	3.81	135	13.3	860	33.7
12	3.98	140	13.6	880	34.1
13	4.14	145	13.8	900	34.5
14	4.30	150	14.1	920	34.8
15	4.45	160	14.5	940	35.2
16	4.60	170	15.0	960	35.6
17	4.73	180	15.4	980	36.0
18	4.87	190	15.8	1000	36.3
19	5.01	200	16.2	1100	38.1
20	5.14	210	16.6	1200	39.8
21	5.26	220	17.0	1300	41.4
22	5.39	230	17.4	1400	43.0
23	5.51	240	17.8	1500	44.5
24	5.62	250	18.2	1600	46.0
25	5.74	260	18.5	1700	47.3
26	5.86	270	18.9	1800	48.7
27	5.97	280	19.2	1900	50.1
28	6.08	290	19.6	2000	51.4
29	6.18	300	19.9	2100	52.6
30	6.30	310	20.2	2200	53.9
31	6.40	320	20.6	2300	55.1
32	6.50	330	20.9	2400	56.2
33	6.60	340	21.2	2500	57.4
34	6.70	350	21.5	2600	58.6
35	6.80	360	21.8	2700	59.7
36	6.90	370	22.1	2800	60.8
37	6.99	380	22.4	2900	61.8
38	7.09	390	22.7	3000	63.0
39	7.17	400	23.0	3100	64.0
40	7.27	410	23.3	3200	65.0
41	7.36	420	23.5	3300	66.0
42	7.44	430	23.8	3400	67.0
43	7.54	440	24.1	3500	68.0
44	7.62	450	24.4	3600	69.0
45	7.70	460	24.6	3700	69.9
46	7.79	470	24.9	3800	70.9
47	7.88	480	25.2	3900	71.7
48	7.96	490	25.4	4000	72.7
49	8.0	500	25.7	4100	73.6
50	8.1	520	26.2	4200	74.4
55	8.5	540	26.7	4300	75.4
60	8.9	560	27.2	4400	76.2
65	9.3	580	27.7	4500	77.0
70	9 6	600	28.1	4700	88.8
75	9.9	620	28.6	5000	81.2
80	10.3	640	29 1	1 mile	83.5

DIP OF THE HORIZON—AT DIFFERENT DISTANCES FROM THE OBSERVER.

Distance of Land in Miles.	HEIGHT OF THE EYE IN FEET.									
	5	10	15	20	25	30	35	40	45	50
M.										
0.1	28′	56′	84′	112′	140′	169′	197′	225′	252′	280′
0.2	14	28	42	56	70	85	99	113	126	140
0.3	9	19	28	37	47	56	65	75	84	93
0.4	7	14	21	28	35	42	49	56	63	70
0.5	6	11	17	22	28	34	39	45	50	56
0.6	5	9	14	19	23	28	33	37	42	47
0.7	4	8	12	16	20	24	28	32	36	40
0 8	4	7	10	14	17	21	25	28	31	35
0 9	3	6	9	12	15	19	22	25	28	31
1.0	3	6	8	11	14	17	20	23	25	27
1.2	3	5	7	9	12	14	16	19	21	23
1.4	3	4	6	8	10	12	14	16	18	20
1.6	3	4	5	7	9	11	13	14	16	18
1.8	2	3	5	6	8	10	12	13	14	16
2.0	2	3	5	6	7	9	11	12	13	15
2.2	2	3	5	6	7	8	10	11	12	14
2.4	2	3	5	6	7	8	9	11	12	13
2.6	2	3	4	5	6	8	9	10	11	12
2.8	2	3	4	5	6	7	8	9	10	11
3.0	2	3	4	5	6	7	8	8	9	10
3.5	2	3	4	5	6	6	7	8	9	9
4.0	2	3	4	4	5	6	7	7	8	8
4.5	2	3	4	4	5	5	6	6	7	8
5.0	2	3	4	4	5	5	6	6	7	7
6.0	2	3	4	4	5	5	6	6	7	7
7.0	2	3	4	4	5	5	6	6	7	7

TABLE, SHOWING THE NUMBER OF MINUTES AND SECONDS CONTAINED IN EACH DEGREE OR 60 MILES OF LONGITUDE FOR EVERY DEGREE OF LATITUDE.

LAT.	MIN. SEC.	LAT.	MIN. SEC.	LAT.	MIN. SEC.	LAT.	MIN. SEC.	LAT.	MIN. SEC.
°	′ ″	°	′ ″	°	′ ″	°	′ ″	°	′ ″
1	59.59	19	56.44	37	47.55	55	34.25	73	17.33
2	59.58	20	56.23	38	47.15	56	33.30	74	16.33
3	59.55	21	56.00	39	46.38	57	32.41	75	15.31
4	59.51	22	55.38	40	45.58	58	31.48	76	14.31
5	59.46	23	55 14	41	45.17	59	30.54	77	13.30
6	59 40	24	54.49	42	44.35	60	30.00	78	12.28
7	59.33	25	54.23	43	43.53	61	29.06	79	11.27
8	59.25	26	53.56	44	43.10	62	28.10	80	10.25
9	59.16	27	53.28	45	42.26	63	27.15	81	9.24
10	59.06	28	52.59	46	41.41	64	26.18	82	8.21
11	58.54	29	52.29	47	40.55	65	25 22	83	7.19
12	58.41	30	51.58	48	40.09	66	24.24	84	6.16
13	58.28	31	51.26	49	39.22	67	23.26	85	5.14
14	58 14	32	50.53	50	38.44	68	22.28	86	4.12
15	57.58	33	50.19	51	37.46	69	21.30	87	3.09
16	57.41	34	49.45	52	36.57	70	20.31	88	2.02
17	57.23	35	49.09	53	36.07	71	19 32	89	1.03
18	57.04	36	48.33	54	35.13	72	18.33	90	0.00

TABLE XVI.

LOGARITHMS FOR COMPUTING THE EQUATION OF EQUAL ALTITUDES.

Interval.	Log A	Log B	Interval.	Log A	Log B	Interval.	Log A	Log B	Interval.	Log A	Log B
h. m.			h. m.			h. m.			h. m.		
2 0	7.7297	7.7146	4 0	7.7447	7.6823	6 0	7.7703	7.6198	8 0	7.8072	7.5062
2	7.7298	7.7143	2	7.7451	7.6815	2	7.7708	7.6184	2	7.8079	7.5036
4	7.7300	7.7139	4	7.7454	7.6807	4	7.7713	7.6170	4	7.8086	7.5010
6	7.7302	7.7136	6	7.7458	7.6800	6	7.7719	7.6156	6	7.8094	7.4983
8	7.7304	7.7132	8	7.7461	7.6792	8	7.7724	7.6142	8	7.8101	7.4957
10	7.7305	7.7128	10	7.7464	7.6784	10	7.7729	7.6127	10	7.8108	7.4930
12	7.7307	7.7125	12	7.7468	7.6776	12	7.7735	7.6113	12	7.8116	7.4902
14	7.7309	7.7121	14	7.7472	7.6768	14	7.7740	7.6098	14	7.8123	7.4874
16	7.7311	7.7117	16	7.7475	7.6759	16	7.7745	7.6083	16	7.8130	7.4846
18	7.7313	7.7113	18	7.7479	7.6751	18	7.7751	7.6068	18	7.8138	7.4818
2 20	7.7315	7.7109	4 20	7.7482	7.6743	6 20	7.7756	7.6053	8 20	7.8145	7.4789
22	7.7317	7.7105	22	7.7486	7.6734	22	7.7762	7.6038	22	7.8153	7.4760
24	7.7319	7.7101	24	7.7490	7.6726	24	7.7767	7.6023	24	7.8160	7.4731
26	7.7321	7.7097	26	7.7494	7.6717	26	7.7773	7.6007	26	7.8168	7.4701
28	7.7323	7.7092	28	7.7497	7.6708	28	7.7779	7.5991	28	7.8176	7.4671
30	7.7325	7.7088	30	7.7501	7.6700	30	7.7784	7.5975	30	7.8183	7.4640
32	7.7327	7.7083	32	7.7505	7.6691	32	7.7790	7.5959	32	7.8191	7.4609
34	7.7329	7.7079	34	7.7509	7.6682	34	7.7796	7.5943	34	7.8199	7.4578
36	7.7331	7.7075	36	7.7513	7.6673	36	7.7801	7.5927	36	7.8206	7.4546
38	7.7333	7.7070	38	7.7517	7.6663	38	7.7807	7.5910	38	7.8214	7.4514
2 40	7.7336	7.7065	4 40	7.7521	7.6654	6 40	7.7813	7.5894	8 40	7.8222	7.4482
42	7.7338	7.7061	42	7.7525	7.6645	42	7.7819	7.5877	42	7.8230	7.4449
44	7.7340	7.7056	44	7.7529	7.6635	44	7.7825	7.5860	44	7.8238	7.4415
46	7.7342	7.7051	46	7.7533	7.6626	46	7.7831	7.5843	46	7.8246	7.4381
48	7.7345	7.7046	48	7.7537	7.6616	48	7.7836	7.5825	48	7.8254	7.4347
50	7.7347	7.7041	50	7.7541	7.6606	50	7.7842	7.5808	50	7.8262	7.4312
52	7.7349	7.7036	52	7.7545	7.6597	52	7.7848	7.5790	52	7.8270	7.4277
54	7.7352	7.7031	54	7.7549	7.6587	54	7.7854	7.5772	54	7.8278	7.4241
56	7.7354	7.7026	56	7.7553	7.6577	56	7.7860	7.5754	56	7.8286	7.4205
58	7.7357	7.7021	58	7.7557	7.6567	58	7.7867	7.5736	58	7.8294	7.4168
3 0	7.7359	7.7015	5 0	7.7562	7.6556	7 0	7.7873	7.5717	9 0	7.8302	7.4131
2	7.7362	7.7010	2	7.7566	7.6546	2	7.7879	7.5699	2	7.8311	7.4093
4	7.7364	7.7005	4	7.7570	7.6536	4	7.7885	7.5680	4	7.8319	7.4055
6	7.7367	7.6999	6	7.7575	7.6525	6	7.7891	7.5661	6	7.8328	7.4016
8	7.7369	7.6993	8	7.7579	7.6514	8	7.7898	7.5641	8	7.8336	7.3977
10	7.7372	7.6988	10	7.7583	7.6504	10	7.7904	7.5622	10	7.8344	7.3937
12	7.7374	7.6982	12	7.7588	7.6493	12	7.7910	7.5602	12	7.8353	7.3896
14	7.7377	7.6976	14	7.7592	7.6482	14	7.7916	7.5582	14	7.8361	7.3855
16	7.7380	7.6970	16	7.7597	7.6471	16	7.7923	7.5562	16	7.8370	7.3813
18	7.7383	7.6964	18	7.7601	7.6460	18	7.7929	7.5542	18	7.8378	7.3771
3 20	7.7386	7.6958	5 20	7.7606	7.6448	7 20	7.7936	7.5522	9 20	7.8387	7.3728
22	7.7388	7.6952	22	7.7610	7.6437	22	7.7942	7.5501	22	7.8396	7.3684
24	7.7391	7.6946	24	7.7615	7.6425	24	7.7949	7.5480	24	7.8404	7.3639
26	7.7394	7.6940	26	7.7620	7.6414	26	7.7955	7.5459	26	7.8413	7.3594
28	7.7397	7.6934	28	7.7624	7.6402	28	7.7962	7.5437	28	7.8422	7.3548
30	7.7400	7.6927	30	7.7629	7.6390	30	7.7969	7.5416	30	7.8430	7.3501
32	7.7403	7.6921	32	7.7634	7.6378	32	7.7975	7.5394	32	7.8439	7.3454
34	7.7406	7.6914	34	7.7638	7.6366	34	7.7982	7.5372	34	7.8448	7.3406
36	7.7409	7.6908	36	7.7643	7.6354	36	7.7989	7.5350	36	7.8457	7.3357
38	7.7412	7.6901	38	7.7648	7.6342	38	7.7995	7.5327	38	7.8466	7.3307
3 40	7.7415	7.6894	5 40	7.7653	7.6329	7 40	7.8002	7.5304	9 40	7.8475	7.3256
42	7.7418	7.6888	42	7.7658	7.6317	42	7.8009	7.5281	42	7.8484	7.3205
44	7.7421	7.6881	44	7.7663	7.6304	44	7.8016	7.5258	44	7.8493	7.3152
46	7.7424	7.6874	46	7.7668	7.6291	46	7.8023	7.5234	46	7.8502	7.3099
48	7.7428	7.6867	48	7.7673	7.6278	48	7.8030	7.5211	48	7.8511	7.3045
50	7.7431	7.6859	50	7.7678	7.6265	50	7.8037	7.5186	50	7.8520	7.2989
52	7.7434	7.6852	52	7.7683	7.6252	52	7.8044	7.5162	52	7.8530	7.2933
54	7.7437	7.6845	54	7.7688	7.6239	54	7.8051	7.5137	54	7.8539	7.2876
56	7.7441	7.6838	56	7.7693	7.6225	56	7.8058	7.5112	56	7.8548	7.2817
58	7.7444	7.6830	58	7.7698	7.6212	58	7.8065	7.5087	58	7.8558	7.2758
4 0	7.7447	7.6823	6 0	7.7703	7.6198	8 0	7.8072	7.5062	10 0	7.8567	7.2697

TABLE XVII.

LOG RISING—TO FIND THE LATITUDE BY REDUCTION TO THE MERIDIAN.

0 Hour.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P. P.	
0	9.				02436	21818	37654	51044	62642	72873	82024	90303		
1	$^{9}_{0}$.97860	04813	11250	17242	22848	28114	33079	37775	42230	46368	50509	54370		
2	0.58066	61612	65019	68297	71455	74503	77448	80296	83054	85726	88319	90837		
3	$^{0}_{1}$.93284	95664	97980	00236	02435	04580	06673	08717	10714	12666	14575	16443		
4	1.18271	20062	21817	23537	25224	26878	28502	30095	31660	33198	34708	36193		
5	1.37653	39088	40501	41890	43258	44605	45931	47237	48524	49792	51041	52273		
6	53488	54686	55868	57034	58184	59320	60440	61547	62639	63718	64784	65837		
7	66877	67905	68920	69924	70917	71898	72869	73829	74778	75717	76646	77565		
8	78474	79374	80265	81147	82019	82884	83739	84587	85426	86257	87080	87896		
9	88703	89504	90297	91083	91862	92634	93399	94157	94909	95655	96394	97127		
10	$^{1}_{2}$.97854	98574	99289	99998	00701	01399	02091	02777	03458	04134	04805	05470	s	
11	2.06131	06786	07437	08082	08723	09359	09991	10618	11240	11859	12472	13082	1	119
12	13687	14288	14885	15477	16066	16651	17232	17809	18382	18951	19517	20079	2	238
13	20638	21192	21744	22292	22836	23377	23915	24449	24980	25508	26033	26554	3	368
14	27073	27589	28100	28609	29116	29619	30120	30617	31112	31604	32093	32579	4	476
15	2.33063	33544	34023	34498	34972	35442	35910	36376	36839	37299	37758	38213	s	
16	38667	39118	39567	40013	40457	40899	41339	41776	42211	42644	43075	43504	1	84
17	43930	44355	44777	45198	45616	46033	46447	46859	47270	47678	48085	48490	2	168
18	48893	49294	49693	50090	50486	50879	51271	51661	52050	52436	52821	53205	3	252
19	53586	53966	54344	54721	55096	55469	55841	56211	56580	56947	57313	57676	4	336
20	2.58039	58400	58759	59117	59474	59829	60182	60534	60885	61234	61582	61929	s	
21	62274	62618	62960	63302	63641	63979	64316	64652	64987	65320	65652	65982	1	65
22	66312	66640	66967	67292	67617	67940	68262	68583	68903	69221	69538	69855	2	130
23	70170	70483	70796	71108	71418	71728	72036	72343	72649	72954	73258	73561	3	195
24	73863	74164	74464	74762	75060	75357	75652	75947	76241	76533	76825	77116	4	260
25	2.77405	77694	77982	78269	78555	78840	79124	79407	79689	79970	80251	80530	s	
26	80809	81086	81363	81639	81914	82188	82461	82734	83005	83276	83546	83815	1	53
27	84083	84350	84617	84883	85148	85412	85675	85937	86199	86460	86720	86979	2	106
28	87238	87496	87753	88009	88265	88519	88773	89027	89279	89531	89782	90032	3	159
29	90282	90531	90779	91027	91273	91520	91765	92010	92254	92497	92739	92981	4	212
30	2.93223	93463	93703	93942	94181	94419	94656	94893	95129	95364	95599	95833	s	
31	96067	96299	96532	96763	96994	97224	97454	97683	97912	98140	98367	98594	1	45
32	$^{2}_{3}$.98820	99045	99270	99495	99719	99942	00164	00386	00608	00829	01049	01269	2	90
33	3.01488	01707	01925	02143	02360	02576	02792	03008	03222	03437	03651	03864	3	134
34	04077	04289	04501	04712	04922	05133	05342	05551	05760	05968	06176	06383	4	178
35	3.06590	06796	07001	07207	07411	07616	07819	08023	08225	08428	08629	08831	s	
36	09032	09232	09432	09632	09831	10029	10227	10425	10622	10819	11015	11211	1	30
37	11406	11601	11796	11990	12184	12377	12570	12762	12954	13146	13337	13527	2	77
38	13718	13908	14097	14286	14475	14663	14850	15038	15225	15411	15597	15783	3	116
39	15969	16154	16338	16522	16706	16889	17072	17255	17437	17619	17800	17982	4	154
40	3.18162	18343	18522	18702	18881	19060	19238	19417	19594	19771	19949	20125	s	
41	20301	20477	20653	20828	21003	21177	21351	21525	21699	21872	22044	22217	1	34
42	22389	22560	22732	22903	23073	23244	23414	23583	23753	23922	24090	24259	2	68
43	24427	24594	24762	24929	25095	25262	25428	25594	25759	25924	26089	26253	3	102
44	26418	26581	26745	26908	27071	27234	27396	27558	27720	27881	28042	28203	4	137
45	3.28363	28524	28683	28843	29002	29161	29320	29478	29637	29794	29952	30109	s	
46	30266	30423	30579	30735	30891	31047	31202	31357	31512	31666	31820	31974	1	31
47	32128	32281	32434	32587	32739	32892	33044	33195	33347	33498	33649	33800	2	62
48	33950	34100	34250	34400	34549	34698	34847	34995	35144	35292	35439	35587	3	92
49	35734	35881	36028	36175	36321	36467	36613	36758	36903	37048	37193	37338	4	122
50	3.37482	37626	37770	37914	38057	38200	38343	38486	38628	38770	38912	39054	s	
51	39195	39336	39477	39618	39759	39899	40039	40179	40319	40458	40597	40736	1	27
52	40875	41013	41152	41290	41427	41565	41702	41839	41976	42113	42250	42386	2	55
53	42522	42658	42794	42929	43064	43199	43334	43469	43603	43737	43871	44005	3	82
54	44138	44272	44405	44537	44670	44803	44935	45067	45199	45331	45462	45593	4	110
55	3.45724	45855	45986	46116	46247	46377	46507	46636	46766	46895	47024	47153	s	
56	47282	47410	47539	47667	47795	37923	48050	48177	48305	48432	48558	48685	1	25
57	48811	48938	49064	49190	49315	49441	49566	49691	49816	49941	50066	50190	2	50
58	50314	50438	50562	50686	50809	50933	51056	51179	51301	51424	51547	51669	3	75
59	51791	51913	52035	52156	52278	52399	52520	52641	52761	52882	53002	53122	4	100

TABLE XVII.

LOG RISING—TO FIND THE LATITUDE BY REDUCTION TO THE MERIDIAN.

1 Hour.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P.	P.
0	3.53243	53362	53482	53602	53721	53840	53959	54078	54197	54315	54434	54552	s	
1	54670	54788	54905	55023	55140	55258	55375	55492	55608	55725	55841	55958	1	23
2	56074	56190	56306	56421	56537	56652	56767	56882	56997	57112	57226	57341	2	46
3	57455	57569	57683	57797	57910	58024	58137	58250	58363	58476	58589	58702	3	70
4	58814	58926	59038	59150	59262	59374	59486	59597	59708	59819	59930	60041	4	93
5	3.60152	60262	60373	60483	60593	60703	60813	60923	61032	61143	61251	61360	s	
6	61469	61578	61686	61795	61903	62012	62120	62228	62336	62443	62551	62659	1	21
7	62766	62873	62980	63087	63194	63301	63407	63513	63620	63726	63832	63938	2	42
8	64043	64149	64254	64360	64465	64570	64675	64780	64885	64989	65094	65198	3	63
9	65302	65406	65510	65614	65717	65821	65924	66028	66131	66234	66337	66440	4	85
10	3.66542	66645	66747	66849	66952	67054	67156	67257	67359	67461	67562	67663	s	
11	67765	67866	67967	68067	68168	68269	68369	68469	68570	68670	68770	68870	1	20
12	68969	69069	69169	69268	69367	69467	69566	69665	69763	69862	69961	70059	2	40
13	70158	70256	70354	70452	70550	70648	70745	70843	70940	71038	71135	71232	3	60
14	71329	71426	71523	71620	71716	71813	71909	72005	72101	72197	72294	72389	4	80
15	3.72485	72580	72676	72771	72867	72962	73057	73152	73247	73341	73436	73530	s	
16	73625	73719	73813	73907	74001	74095	74189	74283	74376	74470	74563	74657	1	18
17	74750	74843	74936	75029	75121	75214	75307	75399	75491	75584	75676	75768	2	37
18	75860	75952	76043	76135	76227	76318	76409	76501	76592	76683	76774	76865	3	55
19	76955	77046	77137	77227	77318	77408	77498	77588	77678	77768	77858	77947	4	74
20	3.78037	78127	78216	78305	78395	78484	78573	78662	78750	78839	78928	79016	s	
21	79195	79193	79282	79370	79458	79546	79634	79722	79809	79897	79985	80072	1	17
22	80159	80247	80334	80421	80508	80595	80682	80768	80855	80942	81028	81115	2	35
23	81201	81287	81373	81459	81545	81631	81717	81802	81888	81974	82059	82144	3	52
24	82230	82315	82400	82485	82570	82655	82739	82824	82908	82993	83077	83162	4	70
25	3.83246	83330	83414	83498	83582	83666	83749	83833	83917	84000	84083	84167	s	
26	84250	84333	84416	81499	84582	84665	84748	84830	84913	84995	85078	85160	1	16
27	85242	85325	85406	85488	85570	85652	85734	85816	85897	85979	86060	86141	2	33
28	86223	86304	86385	86466	86547	86628	86709	86790	86870	86951	87031	87112	3	49
29	87192	87272	87352	87433	87513	87593	87672	87752	87832	87912	87991	88071	4	65
30	3.88150	88229	88309	88388	88467	88546	88625	88704	88783	88862	88940	89019	s	
31	89097	89176	89254	89333	89411	89489	89567	89645	89723	89801	89879	89956	1	15
32	90034	90112	90189	90267	90344	90421	90498	90576	90653	90730	90807	90884	2	31
33	90960	91037	91114	91190	91267	91343	91420	91496	91572	91648	91724	91800	3	46
34	91876	91952	92028	92104	92179	92255	92331	92406	92482	92557	92632	92707	4	62
35	3.92782	92858	92933	93007	93082	93157	93232	93306	93381	93456	93530	93605	s	
36	93679	93753	93827	93901	93975	94049	94123	94197	94271	94345	94418	94492	1	15
37	94566	94639	94712	94786	94859	94932	95005	95078	95152	95224	95297	95370	2	29
38	95443	95515	95588	95661	95733	95806	95878	95950	96023	96095	96167	96239	3	44
39	96311	96383	96455	96527	96599	96670	96742	96813	96885	96956	97028	97099	4	58
40	3.97170	97242	97313	97384	97455	97526	97597	97667	97738	97809	97880	97950	s	
41	98021	98091	98162	98232	98302	98372	98443	98513	98583	98653	98723	98793	1	14
42	98862	98932	99002	99072	99141	99211	99280	99350	99419	99188	99557	99627	2	28
43	¾99696	99765	99834	99903	99972	00040	00109	00178	00247	00315	00384	00452	3	42
44	4.00521	00589	00657	00726	00794	00862	00930	00998	01066	01134	01202	01270	4	56
45	4.01337	01405	01473	01540	01608	01675	01743	01810	01877	01945	02012	02079	s	
46	02146	02213	02280	02347	02414	02481	02547	02614	02681	02747	02814	02880	1	13
47	02947	03013	03080	03146	03212	03278	03344	03411	03477	03542	03608	03674	2	26
48	03740	03806	03871	03937	04003	04068	04134	04199	04265	04330	04395	04460	3	40
49	04526	04591	04656	04721	04786	04851	04916	04980	05045	05110	05175	05239	4	53
50	4.05304	05368	05433	05497	05561	05626	05690	05754	05818	05882	05946	06010	s	
51	06074	06138	06202	06266	06330	06393	06457	06521	06584	06648	06711	06775	1	13
52	06838	06901	06965	07028	07091	07154	07217	07280	07343	07406	07469	07532	2	25
53	07595	07657	07720	07783	07845	07908	07970	08033	08095	08157	08220	08282	3	38
54	08344	08406	08468	08530	08592	08651	08716	08778	08840	08902	08964	09025	4	50
55	4.09087	09148	09210	09272	09333	09394	09456	09517	09578	09640	09701	09762	s	
56	09823	09884	09945	10006	10067	10128	10188	10249	10310	10371	10431	10492	1	12
57	10552	10613	10673	10734	10794	10854	10915	10975	11035	11095	11155	11215	2	24
58	11275	11335	11395	11455	11515	11575	11634	11694	11754	11813	11873	11932	3	36
59	11992	12051	12111	12170	12229	12289	12348	12407	12466	12525	12584	12643	4	48

TABLE XVII.

LOG RISING—TO FIND THE LATITUDE BY REDUCTION TO THE MERIDIAN.

2 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P.	P.
0	4.12702	12761	12820	12879	12938	12996	13055	13114	13172	13231	13289	13348	s	
1	13406	13465	13523	13581	13640	13698	13756	13814	13872	13931	13989	14047	1	11
2	14104	14162	14220	14278	14336	14394	14451	14508	14567	14625	14682	14739	2	23
3	14797	14854	14911	14969	15026	15083	15140	15198	15255	15312	15369	15426	3	34
4	15483	15540	15597	15653	15710	15767	15824	15880	15937	15994	16050	16107	4	46
5	4.16163	16220	16276	16332	16389	16445	16501	16557	16614	16670	16726	16782	s	
6	16838	16894	16950	17006	17062	17117	17173	17229	17285	17340	17396	17451	1	11
7	17507	17563	17618	17673	17729	17784	17840	17895	17950	18005	18060	18116	2	22
8	18171	18226	18281	18336	18391	18445	18500	18555	18610	18665	18719	18774	3	33
9	18829	18883	18938	18992	19047	19101	19156	19210	19265	19319	19373	19427	4	44
10	4.19482	19536	19590	19644	19698	19752	19806	19860	19914	19968	20022	20075	s	
11	20129	20183	20236	20290	20344	20397	20451	20505	20558	20611	20665	20718	1	11
12	20771	20825	20878	20931	20984	21037	21091	21144	21197	21250	21303	21356	2	21
13	21409	21461	21514	21567	21620	21673	21725	21778	21831	21883	21936	21988	3	32
14	22041	22093	22146	22198	22250	22303	22355	22407	22459	22511	22564	22616	4	42
15	4.22668	22720	22772	22824	22876	22928	22980	23031	23083	23135	23187	23238	s	
16	23290	23342	23393	23445	23496	23548	23599	23651	23702	23754	23805	23856	1	10
17	23907	23959	24010	24061	24112	24163	24214	24265	24316	24367	24418	24469	2	20
18	24520	24571	24622	24673	24723	24774	24825	24875	24926	24977	25027	25078	3	31
19	25128	25178	25229	25279	25330	25380	25430	25481	25531	25581	25631	25681	4	41
20	4.25731	25781	25831	25881	25931	25981	26031	26081	26131	26181	26231	26281	s	
21	26330	26380	26429	26479	26529	26578	26628	26677	26727	26776	26826	26875	1	10
22	26924	26974	27023	27072	27121	27171	27220	27269	27318	27367	27416	27465	2	20
23	27514	27563	27612	27661	27710	27759	27807	27856	27905	27954	28002	28051	3	29
24	28099	28148	28197	28245	28294	28342	28391	28439	28187	28536	28584	28632	4	39
25	4.28681	28729	28777	28825	28873	28921	28969	29017	29066	29114	29161	29209	s	
26	29257	29305	29353	29401	29449	29496	29544	29592	29639	29687	29735	29782	1	10
27	29830	29877	29925	29973	30020	30067	30115	30162	30209	30257	30304	30351	2	19
28	30398	30445	30493	30540	30587	30634	30681	30728	30775	30822	30869	30916	3	29
29	30963	31009	31056	31103	31150	31197	31243	31290	31337	31383	31430	31476	4	38
30	4.31523	31569	31616	31662	31709	31755	31801	31848	31894	31940	31987	32033	s	
31	32079	32125	32171	32217	32264	32310	32356	32402	32448	32494	32540	32586	1	9
32	32631	32677	32723	32769	32815	32860	32906	32952	32997	33043	33089	33134	2	18
33	33180	33225	33271	33316	33362	33407	33453	33498	33543	33589	33631	33679	3	28
34	33724	33770	33815	33860	33905	33950	33995	34040	34085	34130	34175	34220	4	37
35	4.34265	34310	34355	34400	34444	34489	34534	34579	34623	34668	34713	34757	s	
36	34802	34847	34891	34936	34980	35025	35069	35114	35158	35202	35247	35291	1	9
37	35335	35380	35424	35468	35512	35556	35601	35645	35689	35733	35777	35821	2	18
38	35865	35909	35953	35997	36041	36085	36128	36172	36216	36260	36303	36347	3	27
39	36391	36435	36478	36522	36565	36609	36653	36696	36740	36783	36827	36870	4	36
40	4.36913	36957	37000	37043	37087	37130	37173	37216	37260	37303	37346	37389	s	
41	37432	37475	37518	37561	37604	37647	37690	37733	37776	37819	37862	37905	1	9
42	37948	37990	38033	38076	38119	38161	38204	38247	38289	38332	38374	38417	2	17
43	38460	38502	38545	38587	38629	38672	38714	38757	38799	38841	38884	38926	3	26
44	38968	39010	39052	39095	39137	39179	39221	39263	39305	39347	39389	39431	4	35
45	4.39473	39515	39557	39599	39641	39683	39725	39766	39808	39850	39892	39933	s	
46	39975	40017	40058	40100	40142	40183	40225	40266	40308	40349	40391	40432	1	8
47	40474	40515	40556	40598	40639	40680	40722	40763	40804	40845	40887	40928	2	17
48	40969	41010	41051	41092	41133	41174	41215	41256	41297	41338	41379	41420	3	25
49	41461	41502	41543	41583	41624	41665	41706	41746	41787	41828	41868	41909	4	34
50	4.41950	41990	42031	42071	42112	42153	42193	42233	42274	42314	42355	42395	s	
51	42435	42476	42516	42556	42597	42637	42677	42717	42758	42798	42838	42878	1	8
52	42918	42958	42998	43038	43078	43118	43158	43198	43238	43278	43318	43358	2	16
53	43398	43437	43477	43517	43557	43597	43636	43676	43716	43755	43795	43835	3	24
54	43874	43914	43953	43993	44032	44072	44111	44151	44190	44229	44269	44308	4	32
55	4.44348	44387	44426	44465	44505	44544	44583	44622	44662	44701	44740	44779	s	
56	44818	44857	44896	44935	44974	45013	45052	45091	45130	45169	45208	45247	1	8
57	45286	45325	45363	45402	45441	45480	45518	45557	45596	45634	45673	45712	2	15
58	45750	45789	45827	45866	45905	45943	45982	46020	46058	46097	46135	46174	3	23
59	46212	46250	46289	46327	46365	46404	46442	46480	46518	46556	46595	46633	4	30

TABLE XVII.

LOG RISING—TO FIND THE LATITUDE BY REDUCTION TO THE MERIDIAN.

3 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P. P.	
0	4.46671	46709	46747	46785	46823	46861	46899	46937	46975	47013	47051	47089	s	
1	47127	47165	47203	47241	47278	47316	47354	47392	47430	47467	47505	47543	1	7
2	47580	47618	47656	47693	47731	47768	47806	47843	47881	47918	47956	47993	2	15
3	48031	48068	48106	48143	48180	48218	48255	48292	48330	48367	48404	48441	3	22
4	48479	48516	48553	48590	48627	48664	48701	48739	48776	48813	48850	48887	4	30
5	4.48924	48961	48998	49035	49071	49108	49145	49182	49219	49256	49293	49329	s	
6	49366	49403	49440	49476	49513	49550	49586	49623	49660	49696	49733	49769	1	7
7	49806	49842	49879	49915	49952	49988	50025	50061	50098	50134	50170	50207	2	14
8	50243	50279	50316	50352	50388	50424	50461	50197	50533	50569	50605	50641	3	22
9	50677	50714	50750	50786	50822	50858	50894	50930	50966	51002	51038	51073	4	29
10	4.51109	51145	51181	51217	51253	51289	51324	51360	51396	51432	51467	51503	s	
11	51539	51574	51610	51646	51681	51717	51753	51788	51824	51859	51895	51930	1	7
12	51966	52001	52037	52072	52107	52143	52178	52213	52249	52284	52319	52355	2	14
13	52390	52425	52461	52496	52531	52566	52601	52636	52672	52707	52742	52777	3	21
14	52812	52847	52882	52917	52952	52987	53022	53057	53092	53127	53162	53197	4	28
15	4.53231	53266	53301	53336	53371	53405	53440	53475	53510	53544	53579	53614	s	
16	53648	53683	53718	53752	53787	53821	53856	53891	53925	53960	53994	54029	1	7
17	54063	54097	54132	54166	54201	54235	54269	54304	54338	54372	54407	54441	2	14
18	54475	54509	54544	54578	54612	54646	54680	54715	54749	54783	54817	54851	3	20
19	54885	54919	54953	54987	55021	55055	55089	55123	55157	55191	55225	55259	4	27
20	4.55293	55327	55360	55394	55428	55462	55496	55529	55563	55597	55630	55664	s	
21	55698	55732	55765	55799	55832	55866	55900	55933	55967	56000	56034	56067	1	7
22	56101	56134	56168	56201	56235	56268	56301	56335	56368	56401	56435	56468	2	13
23	56501	56534	56568	56601	56635	56668	56701	56734	56767	56800	56834	56867	3	20
24	56900	56933	56966	56999	57032	57065	57098	57131	57164	57197	57230	57263	4	26
25	4.57296	57329	57362	57395	57428	57460	57493	57526	57559	57592	57625	57657	s	
26	57690	57723	57755	57788	57821	57854	57886	57919	57951	57984	58017	58049	1	6
27	58082	58114	58147	58179	58212	58244	58277	58309	58342	58374	58407	58439	2	13
28	58471	58504	58536	58568	58601	58633	58665	58698	58730	58762	58794	58827	3	19
29	58859	58891	58923	58955	58988	59020	59052	59084	59116	59148	59180	59212	4	26
30	4.59244	59276	59308	59340	59372	59404	59436	59468	59500	59532	59564	59596	s	
31	59627	59659	59691	59723	59755	59786	59818	59850	59882	59913	59945	59977	1	6
32	60008	60040	60072	60103	60135	60167	60198	60230	60261	60293	60324	60356	2	12
33	60388	60419	60450	60482	60513	60545	60576	60608	60639	60670	60701	60733	3	18
34	60764	60796	60827	60858	60890	60921	60952	60983	61015	61046	61077	61108	4	25
35	4.61139	61171	61202	61233	61264	61295	61326	61357	61388	61419	61450	61481	s	
36	61512	61543	61574	61605	61636	61667	61698	61729	61760	61791	61822	61852	1	6
37	61883	61914	61945	61976	62006	62037	62068	62099	62129	62160	62191	62222	2	12
38	62252	62283	62313	62344	62375	62405	62436	62466	62497	62528	62558	62589	3	18
39	62619	62650	62680	62711	62741	62771	62802	62832	62863	62893	62923	62954	4	24
40	4.62984	63014	63045	63075	63105	63136	63166	63196	63226	63257	63287	63317	s	
41	63347	63377	63407	63438	63468	63498	63528	63558	63588	63618	63648	63678	1	6
42	63708	63738	63768	63798	63828	63858	63888	63918	63948	63978	64008	64038	2	12
43	64068	64097	64127	64157	64187	64217	64246	64276	64306	64336	64365	64395	3	18
44	64425	64455	64484	64514	64544	64573	64603	64632	64662	64692	64721	64751	4	24
45	4.64780	64810	64839	64869	64898	64928	64957	64987	65016	65045	65075	65105	s	
46	65134	65163	65193	65222	65251	65281	65310	65339	65369	65398	65427	65456	1	6
47	65486	65515	65544	65573	65603	65632	65661	65690	65719	65748	65777	65806	2	12
48	65836	65865	65894	65923	65952	65981	66010	66039	66068	66097	66126	66155	3	17
49	66184	66213	66242	66270	66299	66328	66357	66386	66415	66444	66472	66501	4	23
50	4.66530	66559	66588	66616	66645	66674	66702	66731	66760	66789	66817	66846	s	
51	66875	66903	66932	66960	66989	67018	67046	67075	67103	67132	67160	67189	1	6
52	67217	67246	67274	67303	67331	67360	67388	67416	67445	67473	67502	67530	2	12
53	67558	67587	67615	67643	67672	67700	67728	67756	67785	67813	67841	67869	3	17
54	67897	67925	67954	67982	68010	68038	68066	68094	68123	68151	68179	68207	4	23
55	4.68235	68263	68291	68319	68347	68375	68403	68431	68459	68487	68515	68543	s	
56	68571	68599	68627	68654	68682	68710	68738	68766	68794	68821	68849	68877	1	6
57	68905	68933	68960	68988	69016	69043	69071	69099	69127	69154	69182	69210	2	11
58	69237	69265	69292	69320	69348	69375	69403	69430	69458	69486	69513	69540	3	17
59	69568	69595	69623	69650	69678	69705	69733	69760	69788	69815	69842	69870	4	22

TABLE XVII.

LOG RISING—TO FIND THE LATITUDE BY REDUCTION TO THE MERIDIAN.

4 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P.	P.
0	4.69897	69924	69952	69979	70006	70034	70061	70088	70115	70143	70170	70197	s	
1	70224	70252	70279	70306	70333	70360	70387	70415	70442	70469	70496	70523	1	5
2	70550	70577	70604	70631	70658	70685	70712	70739	70766	70793	70820	70847	2	11
3	70874	70901	70928	70955	70982	71009	71036	71063	71089	71116	71143	71170	3	16
4	71197	71224	71250	71277	71304	71331	71357	71384	71411	71438	71464	71491	4	22
5	4.71518	71544	71571	71598	71624	71651	71678	71704	71731	71757	71784	71810	s	
6	71837	71864	71890	71917	71943	71970	71996	72023	72049	72075	72102	72128	1	5
7	72155	72181	72208	72234	72260	72287	72313	72339	72366	72392	72418	72445	2	10
8	72471	72497	72523	72550	72576	72602	72628	72655	72681	72707	72733	72759	3	16
9	72785	72812	72838	72864	72890	72916	72942	72968	72994	73020	73046	73072	4	21
10	4.73099	73125	73151	73177	73203	73228	73254	73280	73306	73332	73358	73384	s	
11	73410	73436	73462	73488	73514	73539	73565	73591	73617	73643	73668	73694	1	5
12	73720	73746	73772	73797	73823	73849	73874	73900	73926	73951	73977	74003	2	10
13	74028	74054	74080	74105	74131	74157	74182	74208	74233	74259	74284	74310	3	15
14	74335	74361	74386	74412	74437	74463	74488	74514	74539	74565	74590	74616	4	20
15	4.74641	74666	74692	74717	74742	74768	74793	74818	74844	74869	74894	74920	s	
16	74945	74970	74995	75021	75046	75071	75096	75122	75147	75172	75197	75222	1	5
17	75247	75273	75298	75323	75348	75373	75398	75423	75448	75473	75498	75523	2	10
18	75549	75574	75599	75624	75649	75674	75699	75723	75748	75773	75798	75823	3	15
19	75848	75873	75898	75923	75948	75973	75997	76022	76047	76072	76097	76121	4	20
20	4.76146	76171	76196	76221	76245	76270	76295	76320	76344	76369	76394	76418	s	
21	76443	76468	76492	76517	76542	76566	76591	76615	76640	76665	76689	76714	1	5
22	76738	76763	76787	76812	76836	76861	76885	76910	76934	76959	76983	77008	2	10
23	77032	77057	77081	77105	77130	77154	77179	77203	77227	77252	77276	77300	3	15
24	77325	77349	77373	77398	77422	77446	77470	77495	77519	77543	77567	77592	4	20
25	4.77616	77640	77664	77688	77713	77737	77761	77785	77809	77833	77857	77882	s	
26	77906	77930	77954	77978	78002	78026	78050	78074	78098	78122	78146	78170	1	5
27	78194	78218	78242	78266	78290	78314	78338	78361	78385	78409	78433	78457	2	10
28	78481	78505	78529	78552	78576	78600	78624	78648	78671	78695	78719	78743	3	14
29	78767	78790	78814	78838	78861	78885	78909	78933	78956	78980	79004	79027	4	19
30	4.79051	79074	79098	79122	79145	79169	79192	79216	79240	79263	79287	79310	s	
31	79334	79357	79381	79404	79428	79451	79475	79498	79522	79545	79568	79592	1	5
32	79615	79639	79662	79686	79709	79732	79756	79779	79802	79826	79849	79872	2	9
33	79896	79919	79942	79965	79989	80012	80035	80059	80082	80105	80128	80151	3	14
34	80175	80198	80221	80244	80267	80290	80314	80337	80360	80383	80406	80429	4	19
35	4.80452	80475	80498	80521	80545	80568	80591	80614	80637	80660	80683	80706	s	
36	80729	80752	80775	80797	80820	80843	80866	80889	80912	80935	80958	80981	1	5
37	81004	81027	81049	81072	81095	81118	81141	81163	81186	81209	81232	81255	2	9
38	81277	81300	81323	81346	81368	81391	81414	81437	81459	81482	81505	81527	3	14
39	81550	81573	81595	81618	81641	81663	81686	81708	81731	81754	81776	81799	4	18
40	4.81821	81844	81866	81889	81911	81934	81956	81979	82001	82024	82046	82069	s	
41	82091	82114	82136	82159	82181	82203	82226	82248	82271	82293	82315	82338	1	4
42	82360	82382	82405	82427	82449	82472	82494	82516	82538	82561	82583	82605	2	9
43	82628	82650	82672	82694	82716	82739	82761	82783	82805	82827	82850	82872	3	13
44	82894	82916	82938	82960	82982	83004	83026	83049	83071	83093	83115	83137	4	18
45	4.83159	83181	83203	83225	83247	83269	83291	83313	83335	83357	83379	83401	s	
46	83423	83445	83467	83488	83510	83532	83554	83576	83598	83620	83642	83663	1	4
47	83685	83707	83729	83751	83773	83794	83816	83838	83860	83881	83903	83925	2	9
48	83947	83968	83990	84012	84034	84055	84077	84099	84120	84142	84164	84185	3	13
49	84207	84229	84250	84272	84293	84315	84337	84358	84380	84401	84423	84444	4	18
50	4.84466	84488	84509	84531	84552	84574	84595	84617	84638	84659	84681	84702	s	
51	84724	84745	84767	84788	84810	84831	84852	84874	84895	84916	84938	84959	1	4
52	84981	85002	85023	85044	85066	85087	85108	85130	85151	85172	85194	85215	2	9
53	85236	85257	85278	85300	85321	85342	85363	85385	85406	85427	85448	85469	3	13
54	85490	85512	85533	85554	85575	85596	85617	85638	85659	85680	85701	85722	4	17
55	4.85744	85765	85786	85807	85828	85849	85870	85891	85912	85933	85954	85975	s	
56	85996	86017	86038	86058	86079	86100	86121	86142	86163	86184	86205	86226	1	4
57	86247	86267	86288	86309	86330	86351	86372	86392	86413	86434	86455	86475	2	8
58	86496	86517	86538	86559	86579	86600	86621	86641	86662	86683	86704	86724	3	13
59	86745	86766	86786	86807	86828	86848	86869	86889	86910	86931	86951	86972	4	17

TABLE XVII.

LOG RISING—TO FIND THE LATITUDE BY REDUCTION TO THE MERIDIAN.

5 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P.	P.
0	4.86992	87013	87034	87054	87075	87095	87116	87136	87157	87177	87198	87218	s	
1	87239	87259	87280	87300	87321	87341	87362	87382	87402	87423	87443	87464	1	4
2	87484	87505	87525	87545	87566	87586	87606	87627	87647	87667	87688	87708	2	8
3	87728	87749	87769	87789	87809	87830	87850	87870	87890	87911	87931	87951	3	12
4	87971	87992	88012	88032	88052	88072	88093	88113	88133	88153	88173	88193	4	16
5	4.88213	88234	88254	88274	88294	88314	88334	88354	88374	88394	88414	88434	s	
6	88451	88474	88494	88514	88534	88554	88574	88594	88614	88634	88654	88674	1	4
7	88694	88714	88734	88754	88774	88794	88814	88834	88853	88873	88893	88913	2	8
8	88933	88953	88973	88992	89012	89032	89052	89072	89091	89111	89131	89151	3	12
9	89171	89190	89210	89230	89250	89269	89289	88309	89328	89348	89368	89388	4	16
10	4.89407	89427	89447	89466	89486	89506	89525	89545	89564	89584	89604	89623	s	
11	89643	89662	89682	89702	89721	89741	89760	89780	89799	89819	89838	89858	1	4
12	89877	89897	89916	89936	89955	89975	89994	90014	90033	90053	90072	90091	2	8
13	90111	90130	90150	90169	90188	90208	90227	90247	90266	90285	90305	90324	3	12
14	90343	90363	90382	90401	90421	90440	90459	90478	90498	90517	90536	90555	4	16
15	4.90575	90594	90613	90632	90652	90671	90690	90709	90728	90748	90767	90786	s	
16	90805	90824	90843	90863	90882	90901	90920	90939	90958	90977	90996	91015	1	4
17	91034	91054	91073	91092	91111	91130	91149	91168	91187	91206	91225	91244	2	8
18	91263	91282	91301	91320	91339	91358	91377	91396	91414	91433	91452	91471	3	11
19	91490	91509	91528	91547	91566	91585	91603	91622	91641	91660	91679	91698	4	15
20	4.91716	91735	91754	91773	91792	91811	91829	91848	91867	91886	91904	91923	s	
21	91942	91961	91979	91998	92017	92035	92054	92073	92092	92110	92129	92148	1	4
22	92166	92185	92203	92222	92241	92259	92278	92297	92315	92334	92352	92371	2	7
23	92390	92408	92427	92145	92464	92483	92501	92519	92538	92556	92575	92593	3	11
24	92612	92630	92649	92667	92686	92704	92723	92741	92760	92778	92796	92815	4	15
25	4.92833	92851	92870	92888	92907	92925	92944	92962	92980	92999	93017	93035	s	
26	93054	93072	93090	93109	93127	93145	93164	93182	93200	93218	93237	93255	1	4
27	93273	93291	93310	93328	93346	93364	93382	93401	93419	93437	93455	93473	2	7
28	93492	93510	93528	93546	93564	93582	93600	93619	93637	93655	93673	93691	3	11
29	93709	93727	93745	93763	93781	93809	93817	93836	93854	93872	93890	93908	4	15
30	4.93926	93914	93962	93980	93998	94016	94034	94052	94069	94088	94105	94123	s	
31	94141	94159	94177	94195	94213	94231	94249	94267	94284	94302	94320	94338	1	4
32	94356	94374	94392	94410	94427	94445	94463	94481	94498	94516	94534	94552	2	7
33	94570	94587	94605	94623	94641	94658	94676	94694	94711	94729	94747	94765	3	11
34	94782	94800	94818	94835	94853	94871	94888	94906	94924	94941	94959	94976	4	14
35	4.94994	95012	95029	95047	95065	95082	95100	95117	95135	95153	95170	95188	s	
36	95205	95223	95240	95258	95275	95293	95310	95328	95345	95363	95380	95398	1	3
37	95415	95433	95450	95468	95485	95502	95520	95537	95555	95572	95589	95607	2	7
38	95624	95642	95659	95676	95694	95711	95728	95746	95763	95780	95798	95815	3	10
39	95832	95850	95867	95884	95902	95919	95936	95953	95971	95988	96005	96022	4	14
40	4.96040	96057	96074	96091	96109	96126	96143	96160	96177	96195	96212	96229	s	
41	96246	96263	96280	96297	96315	96332	96349	96366	96383	96400	96417	96434	1	3
42	96451	96469	96486	96503	96520	96537	96554	96571	96588	96605	96622	96639	2	7
43	96656	96673	96690	96707	96724	96741	96758	96775	96792	96809	96826	96843	3	10
44	96860	96877	96894	96910	96927	96944	96961	96978	96995	97012	97029	97046	4	14
45	4.97062	97079	97096	97113	97130	97147	97163	97180	97197	97214	97231	97247	s	
46	97264	97281	97298	97315	97331	97348	97365	97382	97398	97415	97432	97449	1	3
47	97465	97482	97499	97515	97532	97549	97565	97582	97599	97615	97632	97649	2	7
48	97665	97682	97699	97715	97732	97749	97765	97782	97798	97815	97832	97848	3	10
49	97865	97881	97898	97914	97931	97947	97964	97981	97997	98014	98030	98047	4	13
50	4.98063	98080	98096	98113	98129	98145	98162	98178	98195	98211	98228	98244	s	
51	98261	98277	98293	98310	98326	98343	98359	98375	98392	98408	98425	98441	1	3
52	98457	98474	98490	98506	98523	98539	98555	98572	98588	98604	98620	98637	2	7
53	98653	98669	98686	98702	98718	98734	98751	98767	98783	98799	98816	98832	3	10
54	98848	98864	98880	98897	98913	98929	98945	98961	98977	98994	99010	99026	4	13
55	4.99042	99058	99074	99090	99107	99123	99139	99155	99171	99187	99203	99219	s	
56	99235	99251	99267	99284	99300	99316	99332	99348	99364	99380	99396	99312	1	3
57	99428	99144	99460	99176	99492	99508	99524	99540	99556	99572	99587	99603	2	6
58	99319	99635	99651	99367	99683	99690	99715	99731	99747	99763	99778	99794	3	10
59	99310	99826	99842	99858	99873	99889	99905	99921	99937	99953	99968	99984	4	13

TABLE XVII.

LOG RISING—TO FIND THE LATITUDE BY REDUCTION TO THE MERIDIAN.

6 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P. P.	
0	5.00000	00016	00032	00047	00063	00079	00095	00110	00126	00142	00158	00173	s	
1	00189	00205	00221	00236	00252	00268	00283	00299	00315	00330	00346	00362	1	3
2	00377	00393	00409	00424	00440	00456	00471	00487	00502	00518	00534	00549	2	6
3	00565	00580	00596	00612	00627	00643	00658	00674	00689	00705	00720	00736	3	9
4	00751	00767	00782	00798	00813	00829	00844	00860	00875	00891	00906	00922	4	12
5	5.00937	00953	00968	00984	00999	01014	01030	01045	01061	01076	01091	01107	s	
6	01122	01138	01153	01168	01184	01199	01214	01230	01245	01260	01276	01291	1	3
7	01306	01322	01337	01352	01368	01383	01398	01413	01429	01444	01459	01474	2	6
8	01490	01505	01520	01536	01551	01566	01581	01596	01612	01627	01642	01657	3	9
9	01672	01688	01703	01718	01733	01748	01763	01779	01794	01809	01824	01839	4	12
10	5.01854	01869	01884	01900	01915	01930	01945	01960	01975	01990	02005	02020	s	
11	02035	02050	02065	02080	02095	02110	02125	02140	02155	02170	02185	02200	1	3
12	02215	02230	02245	02260	02275	02290	02305	02320	02335	02350	02365	02380	2	6
13	02395	02410	02425	02440	02455	02469	02484	02499	02514	02529	02544	02559	3	9
14	02574	02588	02603	02618	02633	02648	02663	02677	02692	02707	02722	02737	4	12
15	5.02751	02766	02781	02796	02811	02825	02840	02855	02870	02884	02899	02914	s	
16	02928	02943	02958	02973	02987	03002	03017	03031	03046	03061	03075	03090	1	3
17	03105	03119	03134	03149	03163	03178	03193	03207	03222	03237	03251	03266	2	6
18	03280	03295	03310	03324	03339	03353	03368	03382	03397	03412	03426	03141	3	9
19	03455	03470	03484	03499	03513	03528	03542	03557	03571	03586	03600	03615	4	12
20	5.03629	03644	03658	03673	03687	03701	03716	03730	03745	03759	03774	03788	s	
21	03802	03817	03831	03846	03860	03874	03889	03903	03918	03932	03946	03961	1	3
22	03975	03989	04004	04018	04032	04047	04061	04075	04090	04104	04118	04132	2	6
23	04147	04161	04175	04190	04204	04218	04232	04247	04261	04275	04289	04303	3	9
24	04318	04332	04346	04360	04375	04389	04403	04417	04431	04445	04460	04474	4	12
25	5.04488	04502	04516	04530	04545	04559	04573	04587	04601	04615	04629	04643	s	
26	04657	04672	04686	04700	04714	04728	04742	04756	04770	04784	04798	04812	1	3
27	04826	04840	04854	04868	04882	04896	04910	04924	04938	04952	04966	04980	2	5
28	04994	05008	05022	05036	05050	05064	05078	05092	05106	05120	05134	05148	3	8
29	05162	05175	05189	05203	05217	05231	05245	05259	05273	05286	05300	05314	4	11
30	5.05328	05342	05356	05370	05383	05397	05411	05425	05439	05452	05466	05480	s	
31	05494	05508	05521	05535	05549	05563	05577	05590	05604	05618	05632	05645	1	3
32	05659	05673	05686	05700	05714	05728	05741	05755	05769	05782	05796	05810	2	5
33	05823	05837	05851	05861	05878	05892	05905	05919	05933	05946	05960	05973	3	8
34	05987	06001	06014	06028	06041	06055	06069	06082	06096	06109	06123	06136	4	10
35	5.06150	06163	06177	06191	06204	06218	06231	06245	06258	06272	06285	06299	s	
36	06312	06326	06339	06353	06366	06379	06393	06406	06420	06433	06447	06460	1	3
37	06474	06487	06500	06514	06527	06541	06554	06567	06581	06594	06608	06621	2	5
38	06634	06648	06661	06674	06688	06701	06714	06728	06741	06754	06768	06781	3	8
39	06794	06808	06821	06834	06848	06861	06874	06887	06901	06914	06927	06941	4	10
40	5.06954	06967	06980	06994	07007	07020	07033	07046	07060	07073	07086	07099	s	
41	07112	07126	07139	07152	07165	07178	07192	07205	07218	07231	07244	07257	1	3
42	07270	07284	07297	07310	07323	07336	07349	07362	07375	07388	07401	07415	2	5
43	07428	07441	07454	07467	07480	07493	07506	07519	07532	07545	07558	07571	3	8
44	07584	07597	07610	07623	07636	07649	07662	07675	07688	07701	07714	07727	4	10
45	5.07740	07753	07766	07779	07792	07805	07818	07831	07844	07857	07869	07882	s	
46	07895	07908	07921	07934	07947	07960	07973	07985	07998	08011	08024	08037	1	3
47	08050	08063	08075	08088	08101	08114	08127	08140	08152	08165	08178	08191	2	5
48	08204	08216	08229	08242	08255	08267	08280	08293	08306	08318	08331	08344	3	8
49	03357	08369	08382	08395	08408	08420	08433	08446	08458	08471	08484	08496	4	10
50	5.08509	08522	08534	08547	08560	08572	08585	08598	08610	08623	08636	08648	s	
51	08661	08673	08686	08699	08711	08724	08736	08749	08762	08774	08787	08799	1	2
52	08312	08824	08837	08850	08862	08875	08887	08900	08912	08925	08937	08950	2	5
53	08962	08975	08987	09000	09012	09025	09037	09050	09062	09075	09087	09100	3	7
54	09112	09124	09137	09149	09162	09174	09187	09199	09211	09224	09236	09249	4	10
55	5.09261	09273	09286	09298	09311	09323	09335	09318	09360	09372	09385	09397	s	
56	09409	09422	09434	09146	09459	09471	09483	09496	09508	09520	09533	09545	1	2
57	09557	09569	09582	09594	09606	09618	09631	09643	09655	09667	09680	09692	2	5
58	09704	09716	09729	09741	09753	09765	09777	09790	09802	09814	09826	09838	3	7
59	09851	09863	09875	09887	09899	09911	09924	09936	09948	09960	09972	09984	4	10

TABLE XVII.

LOG RISING—TO FIND THE LATITUDE BY REDUCTION TO THE MERIDIAN.

7 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P. P.	
0	5.09996	10008	10021	10033	10045	10057	10069	10081	10093	10105	10117	10129	s	
1	10141	10153	10166	10178	10190	10202	10214	10226	10238	10250	10262	10274	1	2
2	10286	10298	10310	10322	10334	10346	10358	10370	10382	10394	10400	10418	2	5
3	10430	10441	10454	10465	10477	10489	10501	10513	10525	10537	10549	10561	3	7
4	10573	10585	10597	10608	10620	10632	10644	10656	10668	10680	10691	10703	4	9
5	5.10715	10727	10739	10751	10763	10774	10786	10798	10810	10822	10833	10845	s	
6	10857	10869	10881	10893	10904	10916	10928	10940	10951	10963	10975	10986	1	2
7	10998	11010	11022	11033	11045	11057	11069	11080	11092	11104	11115	11127	2	5
8	11139	11150	11162	11174	11185	11197	11209	11220	11232	11244	11255	11267	3	7
9	11279	11290	11302	11314	11325	11337	11348	11360	11372	11383	11395	11406	4	9
10	5.11418	11429	11441	11453	11464	11476	11487	11499	11510	11522	11533	11545	s	
11	11557	11568	11580	11591	11603	11614	11626	11637	11649	11660	11672	11683	1	2
12	11695	11706	11717	11729	11740	11752	11763	11775	11786	11798	11809	11820	2	5
13	11832	11843	11855	11866	11878	11889	11900	11912	11923	11934	11946	11957	3	7
14	11969	11980	11991	12003	12014	12025	12037	12048	12059	12071	12082	12093	4	9
15	5.12105	12116	12127	12139	12150	12161	12173	12184	12195	12206	12218	12229	s	
16	12240	12251	12263	12274	12285	12296	12308	12319	12330	12341	12353	12364	1	2
17	12375	12386	12397	12409	12420	12431	12442	12453	12465	12476	12487	12498	2	4
18	12509	12520	12532	12543	12554	12565	12576	12587	12598	12610	12621	12632	3	7
19	12643	12654	12665	12676	12687	12698	12709	12721	12732	12743	12754	12765	4	9
20	5.12776	12787	12798	12809	12820	12831	12842	12853	12864	12875	12886	12897	s	
21	12908	12919	12930	12941	12952	12963	12974	12985	12996	13007	13018	13029	1	2
22	13040	13051	13062	13073	13084	13095	13106	13117	13128	13139	13149	13160	2	4
23	13171	13182	13193	13204	13215	13226	13237	13248	13258	13269	13280	13291	3	7
24	13302	13313	13323	13334	13345	13356	13367	13378	13388	13399	13410	13421	4	9
25	5.13431	13442	13453	13464	13475	13486	13496	13507	13518	13529	13539	13550	s	
26	13561	13572	13582	13593	13604	13615	13625	13636	13647	13658	13668	13679	1	2
27	13690	13700	13711	13722	13732	13743	13754	13765	13775	13786	13797	13807	2	4
28	13818	13828	13839	13850	13860	13871	13882	13892	13903	13914	13924	13935	3	7
29	13945	13956	13967	13977	13988	13998	14009	14019	14030	14041	14051	14062	4	9
30	5.14072	14083	14093	14104	14114	14125	14136	14146	14157	14167	14178	14188	s	
31	14199	14209	14220	14230	14241	14251	14262	14272	14282	14293	14303	14314	1	2
32	14324	14335	14345	14356	14366	14377	14387	14397	14408	14418	14429	14439	2	4
33	14449	14460	14470	14481	14491	14501	14512	14522	14533	14543	14553	14564	3	6
34	14574	14584	14595	14605	14615	14626	14636	14646	14657	14667	14677	14688	4	8
35	5.14698	14708	14719	14729	14739	14750	14760	14770	14780	14790	14801	14811	s	
36	14821	14832	14842	14852	14862	14872	14883	14893	14903	14913	14924	14934	1	2
37	14944	14954	14964	14975	14985	14995	15005	15015	15026	15036	15046	15056	2	4
38	15066	15076	15087	15097	15107	15117	15127	15137	15147	15157	15168	15178	3	6
39	15188	15198	15208	15218	15228	15238	15248	15258	15269	15279	15289	15299	4	8
40	5.15309	15319	15329	15339	15349	15359	15369	15379	15389	15399	15409	15419	s	
41	15429	15439	15449	15459	15469	15479	15489	15499	15509	15519	15529	15539	1	2
42	15549	15559	15569	15579	15589	15599	15609	15619	15629	15639	15649	15659	2	4
43	15668	15678	15688	15698	15708	15718	15728	15738	15748	15758	15767	15777	3	6
44	15787	15797	15807	15817	15827	15837	15846	15856	15866	15876	15886	15896	4	8
45	5.15905	15915	15925	15935	15944	15954	15964	15974	15984	15993	16003	16013	s	
46	16023	16033	16042	16052	16062	16072	16081	16091	16101	16111	16120	16130	1	2
47	16140	16149	16159	16169	16179	16188	16198	16208	16217	16227	16237	16246	2	4
48	16256	16266	16276	16285	16295	16304	16314	16324	16333	16343	16353	16362	3	6
49	16372	16382	16391	16401	16410	16420	16430	16439	16449	16459	16468	16478	4	8
50	5.16487	16497	16506	16516	16526	16535	16545	16554	16564	16573	16583	16592	s	
51	16602	16612	16621	16631	16640	16650	16659	16669	16678	16688	16697	16707	1	2
52	16716	16726	16735	16745	16754	16764	16773	16782	16792	16801	16811	16820	2	4
53	16830	16839	16849	16858	16867	16877	16886	16896	16905	16915	16924	16933	3	6
54	16943	16952	16961	16971	16980	16990	16999	17008	17018	17027	17036	17046	4	8
55	5.17055	17065	17074	17083	17093	17102	17111	17121	17130	17139	17148	17158	s	
56	17167	17176	17186	17195	17204	17214	17223	17232	17241	17251	17260	17269	1	2
57	17278	17288	17297	17306	17315	17325	17334	17343	17352	17362	17371	17380	2	4
58	17389	17398	17408	17417	17426	17435	17444	17454	17463	17472	17481	17490	3	6
59	17499	17509	17518	17527	17536	17545	17554	17563	17573	17582	17591	17600	4	8

TABLE XVIII.

LOGARITHMS FOR FINDING THE APPARENT TIME OR HORARY ANGLE.

0 Hour.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P. P.	
0	$\frac{3}{4}$.	51921	12127	47345	72333	91715	07551	20941	32539	42770	51921	60200		
1	$\frac{4}{5}$.67757	74710	81147	87139	92745	98011	02976	07672	12127	16365	20406	24267		
2	5.27963	31509	34916	38194	41352	44400	46345	50193	52951	55623	58216	60734		
3	63181	65561	67877	70133	72332	74477	76570	78614	80611	82563	84472	86340		
4	$\frac{5}{6}$.88168	89959	91714	93434	95121	96775	98399	99992	01557	03095	04605	06090		
5	6.07550	08985	10398	11787	13155	14502	15828	17131	18421	19689	20938	22170		
6	23385	24583	25765	26931	28081	29217	30337	31444	32536	33615	34681	35734		
7	36774	37802	38817	39821	40814	41795	42766	43726	44675	45614	46543	47462		
8	48372	49271	50162	51044	51916	52780	53636	54484	55323	56151	56977	57792		
9	58600	59401	60194	60980	61759	62531	63296	64054	64806	65552	66291	67024		
10	6.67751	68471	69186	69895	70598	71296	71988	72674	73355	74031	74702	75367	s	
11	76028	76683	77334	77979	78620	79256	79888	80515	81137	81756	82369	82979	1	119
12	83584	84185	84782	85374	85963	86548	87129	87706	88279	88848	89414	89976	2	238
13	90535	91089	91641	92189	92733	93274	93812	94346	94877	95405	95930	96451	3	358
14	$\frac{6}{7}$.96970	97485	97997	98506	99013	99516	00017	00514	01009	01501	01990	02476	4	476
15	7.02960	03441	03920	04395	04869	05339	05807	06273	06736	07196	07655	08110	s	
16	08564	09015	09464	09910	10354	10796	11236	11673	12108	12541	12972	13401	1	84
17	13827	14252	14674	15095	15513	15930	16344	16756	17167	17575	17982	18387	2	168
18	18790	19191	19590	19987	20383	20776	21168	21558	21947	22333	22719	23102	3	252
19	23483	23863	24241	24618	24993	25366	25738	26108	26477	26844	27210	27573	4	336
20	7.27936	28297	28656	29014	29371	29726	30079	30431	30782	31131	31479	31826	s	
21	32171	32515	32857	33198	33538	33876	34213	34549	34884	35217	35549	35879	1	65
22	36209	36537	36864	37189	37514	37837	38159	38480	38800	39118	39435	39752	2	130
23	40067	40380	40693	41005	41315	41625	41933	42240	42546	42851	43155	43458	3	195
24	43760	44061	44361	44659	44957	45251	45549	45844	46138	46430	46722	47013	4	260
25	7.47302	47591	47879	48166	48452	48737	49021	49304	49586	49867	50148	50427	s	
26	50706	50983	51260	51536	51811	52085	52358	52631	52902	53173	53443	53712	1	53
27	53980	54247	54514	54780	55045	55308	55572	55834	56096	56357	56617	56876	2	106
28	57135	57393	57650	57906	58162	58416	58670	58924	59176	59428	59679	59929	3	159
29	60179	60428	60676	60924	61170	61417	61662	61907	62151	62394	62636	62878	4	212
30	7.63120	63360	63600	63839	64078	64316	64553	64790	65026	65261	65496	65730	s	
31	65964	66196	66429	66660	66891	67121	67351	67580	67809	68037	68264	68491	1	45
32	68717	68942	69167	69392	69616	69839	70061	70283	70505	70726	70946	71166	2	90
33	71385	71604	71822	72040	72257	72473	72689	72904	73119	73334	73548	73760	3	134
34	73974	74186	74398	74609	74819	75030	75239	75448	75657	75865	76073	76280	4	178
35	7.76487	76693	76898	77104	77308	77513	77716	77920	78122	78325	78526	78728	s	
36	78929	79129	79329	79529	79728	79926	80124	80322	80519	80716	80912	81108	1	39
37	81303	81498	81693	81887	82081	82274	82467	82659	82851	83043	83234	83424	2	77
38	83615	83804	83994	84183	84372	84560	84747	84935	85122	85308	85494	85680	3	116
39	85866	86050	86235	86419	86603	86786	86969	87152	87334	87516	87697	87878	4	154
40	7.88059	88240	88419	88599	88778	88957	89135	89314	89491	89668	89846	90022	s	
41	90198	90374	90550	90725	90900	91074	91248	91422	91596	91769	91941	92113	1	34
42	92286	92457	92629	92800	92970	93141	93311	93480	93650	93819	93987	94156	2	68
43	94324	94491	94659	94826	94992	95159	95325	95491	95656	95821	95986	96150	3	102
44	96315	96478	96642	96805	96968	97131	97293	97455	97617	97778	97939	98100	4	137
45	$\frac{7}{8}$.98260	98421	98580	98740	98899	99058	99217	99375	99534	99691	99849	00006	s	
46	8.00163	00320	00476	00632	00788	00944	01099	01254	01409	01563	01717	01871	1	31
47	02025	02178	02331	02484	02636	02789	02941	03092	03244	03395	03546	03697	2	62
48	03847	03997	04147	04297	04446	04595	04744	04892	05041	05189	05336	05484	3	92
49	05631	05778	05925	06072	06218	06364	06510	06655	06800	06945	07090	07235	4	122
50	8.07379	07523	07667	07811	07954	08097	08240	08383	08525	08667	08809	08951	s	
51	09092	09233	09374	09515	09656	09796	09936	10076	10216	10355	10494	10633	1	27
52	10772	10910	11048	11187	11324	11462	11599	11736	11873	12010	12147	12283	2	55
53	12419	12555	12691	12826	12961	13096	13231	13366	13500	13634	13768	13902	3	82
54	14035	14169	14302	14434	14567	14700	14832	14964	15096	15228	15359	15490	4	110
55	8.15621	15752	15883	16013	16144	16274	16404	16533	16663	16792	16921	17050	s	
56	17179	17307	17436	17564	17692	17820	17947	18074	18202	18329	18455	18582	1	25
57	18708	18835	18961	19087	19212	19338	19463	19588	19713	19838	19963	20087	2	50
58	20211	20335	20459	20583	20706	20830	20953	21076	21198	21321	21444	21566	3	75
59	21688	21810	21932	22053	22175	22296	22417	22538	22658	22779	22899	23019	4	10

TABLE XVIII.

LOGARITHMS FOR FINDING THE APPARENT TIME OR HORARY ANGLE.

1 Hour.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P.	P.
0	8.23140	23259	23379	23499	23618	23737	23856	23975	24094	24212	24331	24449	s	
1	24567	24685	24802	24920	25037	25155	25272	25389	25505	25622	25738	25855	1	23
2	25971	26087	26203	26318	26434	26549	26664	26779	26894	27009	27123	27238	2	46
3	27352	27466	27580	27694	27807	27921	28034	28147	28260	28373	28486	28599	3	70
4	28711	28823	28935	29047	29159	29271	29383	29494	29605	29716	29827	29938	4	93
5	8.30049	30159	30270	30380	30490	30600	30710	30820	30929	31039	31148	31257	s	
6	31366	31475	31583	31692	31800	31909	32016	32125	32233	32340	32448	32556	1	21
7	32663	32770	32877	32984	33091	33198	33304	33410	33517	33623	33729	33835	2	42
8	33940	34046	34151	34257	34362	34467	34572	34677	34782	34886	34991	35095	3	63
9	35199	35303	35407	35511	35614	35718	35821	35925	36028	36131	36234	36337	4	85
10	8.36439	36542	36644	36746	36849	36951	37053	37154	37256	37358	37459	37560	s	
11	37662	37763	37864	37964	38065	38166	38266	38366	38467	38567	38667	38767	1	20
12	38866	38966	39066	39165	39264	39364	39463	39562	39660	39759	39858	39956	2	40
13	40055	40153	40251	40349	40447	40545	40642	40740	40837	40935	41032	41129	3	60
14	41226	41323	41420	41517	41613	41710	41806	41902	41998	42094	42191	42286	4	80
15	8.42382	42477	42573	42668	42764	42859	42954	43049	43144	43238	43333	43427	s	
16	43522	43616	43710	43804	43898	43992	44086	44180	44273	44367	44460	44554	1	18
17	44647	44740	44833	44926	45018	45111	45204	45296	45388	45481	45573	45665	2	37
18	45757	45849	45940	46032	46124	46215	46306	46398	46489	46580	46671	46762	3	55
19	46852	46943	47034	47124	47215	47305	47395	47485	47575	47665	47755	47844	4	74
20	8.47934	48024	48113	48202	48292	48381	48470	48559	48647	48736	48825	48913	s	
21	49002	49090	49179	49267	49355	49443	49531	49619	49706	49794	49882	49969	1	17
22	50056	50143	50231	50318	50405	50492	50579	50665	50752	50839	50925	51012	2	35
23	51098	51184	51270	51356	51442	51528	51614	51699	51785	51871	51956	52041	3	52
24	52127	52212	52297	52382	52467	52552	52636	52721	52805	52890	52974	53059	4	70
25	8.53143	53227	53311	53395	53479	53563	53646	53730	53814	53897	53980	54064	s	
26	54147	54230	54313	54396	54479	54562	54645	54727	54810	54892	54975	55057	1	16
27	55139	55221	55303	55385	55467	55549	55631	55713	55794	55876	55957	56038	2	33
28	56120	56201	56282	56363	56444	56525	56606	56687	56767	56848	56928	57009	3	49
29	57089	57169	57249	57330	57410	57490	57569	57649	57729	57809	57888	57968	4	65
30	8.58047	58126	58206	58285	58364	58443	58522	58601	58680	58759	58837	58916	s	
31	58994	59073	59151	59230	59308	59386	59464	59542	59620	59698	59776	59853	1	15
32	59931	60009	60086	60164	60241	60318	60395	60473	60550	60627	60704	60781	2	31
33	60857	60934	61011	61087	61164	61240	61317	61393	61469	61545	61621	61697	3	46
34	61773	61849	61925	62001	62076	62152	62228	62303	62379	62454	62529	62604	4	62
35	8.62679	62755	62830	62904	62979	63054	63129	63203	63278	63353	63427	63502	s	
36	63576	63650	63724	63798	63872	63946	64020	64094	64168	64242	64315	64389	1	15
37	64463	64536	64609	64683	64756	64829	64902	64975	65048	65121	65194	65267	2	29
38	65340	65412	65485	65558	65630	65703	65775	65847	65920	65992	66064	66136	3	44
39	66208	66280	66352	66424	66496	66567	66639	66710	66782	66853	66925	66996	4	58
40	8.67067	67139	67209	67281	67352	67423	67494	67564	67635	67706	67777	67847	s	
41	67918	67988	68059	68129	68199	68269	68340	68410	68480	68550	68620	68690	1	14
42	68759	68829	68899	68969	69038	69108	69177	69247	69316	69385	69454	69524	2	28
43	69593	69662	69731	69800	69869	69937	70006	70075	70144	70212	70281	70349	3	42
44	70418	70486	70554	70623	70691	70759	70827	70895	70963	71031	71099	71167	4	56
45	8.71234	71302	71370	71437	71505	71572	71640	71707	71774	71842	71909	71976	s	
46	72043	72110	72177	72244	72311	72378	72444	72511	72578	72644	72711	72777	1	13
47	72844	72910	72977	73043	73109	73175	73241	73308	73374	73439	73505	73571	2	26
48	73637	73703	73768	73834	73900	73965	74031	74096	74162	74227	74292	74357	3	40
49	74423	74488	74553	74618	74683	74748	74813	74877	74942	75007	75072	75136	4	53
50	8.75201	75265	75330	75394	75458	75523	75587	75651	75715	75779	75843	75907	s	
51	75971	76035	76099	76163	76227	76290	76354	76418	76481	76545	76608	76672	1	13
52	76735	76798	76862	76925	76988	77051	77114	77177	77240	77303	77366	77429	2	25
53	77492	77554	77617	77680	77742	77805	77867	77930	77992	78054	78117	78179	3	38
54	78241	78303	78365	78427	78489	78551	78613	78675	78737	78799	78861	78922	4	50
55	8.78984	79045	79107	79169	79230	79291	79353	79414	79475	79537	79598	79659	s	
56	79720	79781	79842	79903	79964	80025	80085	80146	80207	80268	80328	80389	1	12
57	80449	80510	80570	80631	80691	80751	80812	80872	80932	80992	81052	81112	2	24
58	81172	81232	81292	81352	81412	81472	81531	81591	81651	81710	81770	81829	3	36
59	81889	81948	82008	82067	82126	82186	82245	82304	82363	82422	82481	82540	4	48

TABLE XVIII.

LOGARITHMS FOR FINDING THE APPARENT TIME OR HORARY ANGLE.

2 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P.	P.
0	8.82599	82658	82717	82776	82835	82893	82952	83011	83069	83128	83187	83245	s	
1	83303	83362	83420	83478	83537	83595	83653	83711	83769	83828	83885	83944	1	11
2	84001	84059	84117	84175	84233	84291	84348	84406	84464	84521	84579	84636	2	23
3	84694	84751	84808	84866	84923	84980	85037	85095	85152	85209	85266	85323	3	34
4	85380	85437	85494	85550	85607	85664	85721	85777	85834	85891	85947	86004	4	46
5	8.86060	86117	86173	86229	86286	86342	86398	86454	86511	86567	86623	86679	s	
6	86735	86791	86847	86903	86959	87014	87070	87126	87182	87237	87293	87348	1	11
7	87404	87460	87515	87570	87626	87681	87736	87792	87847	87902	87957	88013	2	22
8	88068	88123	88178	88233	88288	88342	88397	88452	88507	88562	88616	88671	3	33
9	88726	88780	88835	88889	88944	88998	89053	89107	89162	89216	89270	89324	4	41
10	8.89379	89433	89487	89541	89595	89649	89703	89757	89811	89865	89918	89972	s	
11	90026	90080	90133	90187	90241	90294	90348	90401	90455	90508	90562	90615	1	11
12	90668	90722	90775	90828	90881	90934	90988	91041	91094	91147	91200	91253	2	21
13	91306	91358	91411	91464	91517	91570	91622	91675	91728	91780	91833	91885	3	32
14	91938	91990	92043	92095	92147	92200	92252	92304	92356	92408	92461	92513	4	42
15	8.92565	92617	92669	92721	92773	92825	92877	92928	92980	93032	93084	93135	s	
16	93187	93239	93290	93342	93393	93445	93496	93548	93599	93651	93702	93753	1	10
17	93804	93856	93907	93958	94009	94060	94111	94162	94213	94264	94315	94366	2	20
18	94417	94468	94519	94570	94620	94671	94722	94772	94823	94874	94924	94975	3	31
19	95025	95075	95126	95176	95227	95277	95327	95378	95428	95478	95528	95578	4	41
20	8.95628	95678	95728	95778	95828	95878	95928	95978	96028	96078	96128	96178	s	
21	96227	96277	96326	96376	96426	96475	96525	96574	96624	96673	96723	96772	1	10
22	96821	96871	96920	96969	97018	97068	97117	97166	97215	97264	97313	97362	2	20
23	97411	97460	97509	97558	97607	97656	97704	97753	97802	97851	97899	97948	3	29
24	97996	98045	98094	98142	98191	98239	98288	98336	98384	98433	98481	98529	4	39
25	8.98578	98626	98674	98722	98770	98818	98866	98914	98963	99011	99058	99106	s	
26	99154	99202	99250	99298	99346	99393	99441	99489	99536	99584	99632	99676	1	10
27	$\overset{8}{9}$.99727	99774	99822	99869	99917	99964	00012	00059	00106	00154	00201	00248	2	19
28	9.00295	00342	00390	00437	00484	00531	00578	00625	00672	00719	00766	00813	3	29
29	00860	00906	00953	01000	01047	01094	01140	01187	01234	01280	01327	01373	4	38
30	9.01420	01466	01513	01559	01606	01652	01698	01745	01791	01837	01884	01930	s	
31	01976	02022	02068	02114	02161	02207	02253	02299	02345	02391	02437	02483	1	9
32	02528	02574	02620	02666	02712	02757	02803	02849	02894	02940	02986	03031	2	18
33	03077	03122	03168	03213	03259	03304	03350	03395	03440	03486	03531	03576	3	28
34	03621	03667	03712	03757	03802	03847	03892	03937	03982	04027	04072	04117	4	37
35	9.04162	04207	04252	04297	04341	04386	04431	04476	04520	04565	04610	04654	s	
36	04699	04744	04788	04833	04877	04922	04966	05011	05055	05099	05144	05188	1	9
37	05232	05277	05321	05365	05409	05453	05498	05542	05586	05630	05674	05718	2	18
38	05762	05806	05850	05894	05938	05982	06025	06069	06113	06157	06200	06244	3	27
39	06288	06332	06375	06419	06462	06506	06550	06593	06637	06680	06724	06767	4	36
40	9.06810	06854	06897	06940	06984	07027	07070	07113	07157	07200	07243	07286	s	
41	07329	07372	07415	07458	07501	07544	07587	07630	07673	07716	07759	07802	1	9
42	07845	07887	07930	07973	08016	08058	08101	08144	08186	08229	08271	08314	2	17
43	08357	08399	08442	08484	08526	08569	08611	08654	08696	08738	08781	08823	3	26
44	08865	08907	08949	08992	09034	09076	09118	09160	09202	09244	09286	09328	4	35
45	9.09370	09412	09454	09496	09538	09580	09622	09663	09705	09747	09789	09830	s	
46	09872	09914	09955	09997	10039	10080	10122	10163	10205	10246	10288	10329	1	8
47	10371	10412	10453	10495	10536	10577	10619	10660	10701	10742	10784	10825	2	17
48	10866	10907	10948	10989	11030	11071	11112	11153	11194	11235	11276	11317	3	25
49	11358	11399	11440	11480	11521	11562	11603	11643	11684	11725	11765	11806	4	34
50	9.11847	11887	11928	11968	12009	12050	12090	12130	12171	12211	12252	12292	s	
51	12332	12373	12413	12453	12494	12534	12574	12614	12655	12695	12735	12775	1	8
52	12815	12855	12895	12935	12975	13015	13055	13095	13135	13175	13215	13255	2	16
53	13295	13334	13374	13414	13454	13494	13533	13573	13613	13652	13692	13732	3	24
54	13771	13811	13850	13890	13929	13969	14008	14048	14087	14126	14166	14205	4	32
55	9.14245	14284	14323	14362	14402	14441	14480	14519	14559	14598	14637	14676	s	
56	14715	14754	14793	14832	14871	14910	14949	14988	15027	15066	15105	15144	1	8
57	15183	15221	15260	15299	15338	15377	15415	15454	15493	15531	15570	15609	2	15
58	15647	15686	15724	15763	15802	15840	15879	15917	15955	15994	16032	16071	3	23
59	16109	16147	16186	16224	16262	16301	16339	16377	16415	16453	16492	16530	4	30

TABLE XVIII.

LOGARITHMS FOR FINDING THE APPARENT TIME OR HORARY ANGLE.

3 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P. P.	
0	9.16568	16608	16644	16682	16720	16758	16796	16834	16872	16910	16948	16986	s	
1	17024	17062	17100	17138	17175	17213	17251	17289	17326	17364	17402	17440	1	7
2	17477	17515	17553	17590	17628	17665	17703	17740	17778	17815	17853	17890	2	15
3	17928	17965	18003	18040	18077	18115	18152	18189	18227	18264	18301	18338	3	22
4	18376	18413	18450	18487	18524	18561	18598	18636	18673	18710	18747	18784	4	30
5	9.18821	18858	18895	18932	18968	19005	19042	19079	19116	19153	19190	19226	s	
6	19263	19300	19337	19373	19410	19447	19483	19520	19557	19593	19630	19666	1	7
7	19703	19739	19776	19812	19849	19885	19922	19958	19995	20031	20067	20104	2	14
8	20140	20176	20213	20249	20285	20321	20358	20394	20430	20466	20502	20538	3	22
9	20575	20611	20647	20683	20719	20755	20791	20827	20863	20899	20935	20970	4	29
10	9.21006	21042	21078	21114	21150	21186	21221	21257	21293	21329	21364	21400	s	
11	21436	21471	21507	21543	21578	21614	21650	21685	21721	21756	21792	21827	1	7
12	21863	21898	21934	21969	22004	22040	22075	22111	22146	22181	22216	22252	2	14
13	22287	22322	22358	22393	22428	22463	22498	22533	22569	22604	22639	22674	3	21
14	22709	22744	22779	22814	22849	22884	22919	22954	22989	23024	23059	23094	4	28
15	9.23128	23163	23198	23233	23268	23302	23337	23372	23407	23441	23476	23511	s	
16	23545	23580	23615	23649	23684	23718	23753	23788	23822	23857	23891	23926	1	7
17	23960	23994	24029	24063	24098	24132	24166	24201	24235	24269	24304	24338	2	14
18	24372	24406	24441	24475	24509	24543	24577	24612	24646	24680	24714	24748	3	20
19	24782	24816	24850	24884	24918	24952	24986	25020	25054	25088	25122	25156	4	27
20	9.25190	25224	25257	25291	25325	25359	25393	25426	25460	25494	25527	25561	s	
21	25595	25629	25662	25696	25729	25763	25796	25830	25864	25897	25931	25964	1	7
22	25998	26031	26065	26098	26132	26165	26198	26232	26265	26298	26332	26365	2	13
23	26398	26432	26465	26498	26532	26565	26598	26631	26664	26697	26731	26764	3	20
24	26797	26830	26863	26896	26929	26962	26995	27028	27061	27094	27127	27160	4	26
25	9.27193	27226	27259	27292	27325	27357	27390	27423	27456	27489	27521	27554	s	
26	27587	27620	27652	27685	27718	27751	27783	27816	27848	27881	27914	27946	1	6
27	27979	28011	28044	28076	28109	28141	28174	28206	28239	28271	28304	28336	2	13
28	28368	28401	28433	28465	28498	28530	28562	28595	28627	28659	28691	28724	3	19
29	28756	28788	28820	28852	28885	28917	28949	28981	29013	29045	29077	29109	4	26
30	9.29141	29173	29205	29237	29269	29301	29333	29365	29397	29429	29461	29493	s	
31	29524	29556	29588	29620	29652	29683	29715	29747	29779	29810	29842	29874	1	6
32	29905	29937	29969	30000	30032	30064	30095	30127	30158	30190	30221	30253	2	12
33	30285	30316	30347	30379	30410	30442	30473	30505	30536	30567	30599	30630	3	18
34	30661	30693	30724	30755	30787	30818	30849	30880	30912	30943	30974	31005	4	25
35	9.31036	31068	31099	31130	31161	31192	31223	31254	31285	31316	31347	31378	s	
36	31409	31440	31471	31502	31533	31564	31595	31626	31657	31688	31719	31749	1	6
37	31780	31811	31842	31873	31903	31934	31965	31996	32026	32057	32088	32119	2	12
38	32149	32180	32210	32241	32272	32302	32333	32363	32394	32425	32455	32486	3	18
39	32516	32547	32577	32608	32638	32668	32699	32729	32760	32790	32820	32851	4	24
40	9.32881	32911	32942	32972	33002	33033	33063	33093	33123	33154	33184	33214	s	
41	33244	33274	33304	33335	33365	33395	33425	33455	33485	33515	33545	33575	1	6
42	33605	33635	33665	33695	33725	33755	33785	33815	33845	33875	33905	33935	2	12
43	33965	33994	34024	34054	34084	34114	34143	34173	34203	34233	34262	34292	3	18
44	34322	34352	34381	34411	34441	34470	34500	34529	34559	34589	34618	34648	4	24
45	9.34677	34707	34736	34766	34795	34825	34854	34884	34913	34943	34972	35002	s	
46	35031	35060	35090	35119	35148	35178	35207	35236	35266	35295	35324	35353	1	6
47	35383	35412	35441	35470	35499	35529	35558	35587	35616	35645	35674	35703	2	12
48	35733	35762	35791	35820	35849	35878	35907	35936	35965	35994	36023	36052	3	17
49	36081	36110	36139	36167	36196	36225	36254	36283	36312	36341	36369	36398	4	23
50	9.36427	36456	36485	36513	36542	36571	36599	36628	36657	36686	36714	36743	s	
51	36771	36800	36829	36857	36886	36915	36943	36972	37000	37029	37057	37086	1	6
52	37114	37143	37171	37200	37228	37257	37285	37313	37342	37370	37399	37427	2	11
53	37455	37484	37512	37540	37568	37597	37625	37653	37682	37710	37738	37766	3	17
54	37794	37823	37851	37879	37907	37935	37963	37991	38020	38048	38076	38104	4	23
55	9.38132	38160	38188	38216	38244	38272	38300	38328	38356	38384	38412	38440	s	
56	38468	38496	38524	38551	38579	38607	38635	38663	38691	38718	38746	38774	1	6
57	38802	38830	38857	38885	38913	38940	38968	38996	39024	39051	39079	39107	2	11
58	39134	39162	39189	39217	39245	39272	39300	39327	39355	39382	39410	39437	3	17
59	39465	39492	39520	39547	39575	39602	39630	39657	39684	39712	39739	39767	4	22

TABLE XVIII.

LOGARITHMS FOR FINDING THE APPARENT TIME OR HORARY ANGLE.

4 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P. P.	
0	9.39794	39821	39849	39876	39903	39931	39958	39985	40012	40040	40067	40094	s	
1	40121	40149	40176	40203	40230	40257	40284	40312	40339	40366	40393	40420	1	5
2	40447	40474	40501	40528	40555	40582	40609	40636	40663	40690	40717	40744	2	11
3	40771	40798	40825	40852	40879	40906	40933	40960	40986	41013	41040	41067	3	16
4	41094	41121	41147	41174	41201	41228	41254	41281	41308	41335	41361	41388	4	22
5	9.41415	41441	41468	41495	41521	41548	41575	41601	41628	41654	41681	41707	s	
6	41734	41761	41787	41814	41840	41867	41893	41920	41946	41972	41999	42025	1	5
7	42052	42078	42105	42131	42157	42184	42210	42236	42263	42289	42315	42342	2	10
8	42368	42394	42420	42447	42473	42499	42525	42552	42578	42604	42630	42656	3	16
9	42682	42709	42735	42761	42787	42813	42839	42865	42891	42917	42943	42969	4	21
10	9.42996	43022	43048	43074	43100	43125	43151	43177	43203	43229	43255	43281	s	
11	43307	43333	43359	43385	43411	43436	43462	43488	43514	43540	43565	43591	1	5
12	43617	43643	43669	43694	43720	43746	43771	43797	43823	43848	43874	43900	2	10
13	43925	43951	43977	44002	44028	44054	44079	44105	44130	44156	44181	44207	3	15
14	44232	44258	44283	44309	44334	44360	44385	44411	44436	44462	44487	44513	4	20
15	9.44538	44563	44589	44614	44639	44665	44690	44715	44741	44766	44791	44817	s	
16	44842	44867	44892	44918	44943	44968	44993	45019	45044	45069	45094	45119	1	5
17	45144	45170	45195	45220	45245	45270	45295	45320	45345	45370	45395	45420	2	10
18	45446	45471	45496	45521	45546	45571	45595	45620	45645	45670	45695	45720	3	15
19	45745	45770	45795	45820	45845	45870	45894	45919	45944	45969	45994	46018	4	20
20	9.46043	46068	46093	46118	46142	46167	46192	46217	46241	46266	46291	46315	s	
21	46340	46365	46389	46414	46439	46463	46488	46512	46537	46562	46586	46611	1	5
22	46635	46660	46684	46709	46733	46758	46782	46807	46831	46856	46880	46905	2	10
23	46929	46954	46978	47002	47027	47051	47076	47100	47124	47149	47173	47197	3	15
24	47222	47246	47270	47295	47319	47343	47367	47392	47416	47440	47464	47489	4	20
25	9.47513	47537	47561	47585	47610	47634	47658	47682	47706	47730	47754	47779	s	
26	47803	47827	47851	47875	47899	47923	47947	47971	47995	48019	48043	48067	1	5
27	48091	48115	48139	48163	48187	48211	48235	48258	48282	48306	48330	48354	2	10
28	48378	48402	48426	48449	48473	48497	48521	48545	48568	48592	48616	48640	3	14
29	48664	48687	48711	48735	48758	48782	48806	48830	48853	48877	48900	48924	4	19
30	9.48948	48971	48995	49019	49042	49066	49089	49113	49137	49160	49184	49207	s	
31	49231	49254	49278	49301	49325	49348	49372	49395	49419	49442	49465	49489	1	5
32	49512	49536	49559	49583	49606	49629	49653	49676	49699	49723	49746	49769	2	9
33	49793	49816	49839	49862	49886	49909	49932	49956	49979	50002	50025	50048	3	14
34	50071	50095	50118	50141	50164	50187	50211	50234	50257	50280	50303	50326	4	19
35	9.50349	50372	50395	50418	50441	50465	50488	50511	50534	50557	50580	50603	s	
36	50626	50649	50672	50694	50717	50740	50763	50786	50809	50832	50855	50878	1	5
37	50901	50924	50946	50969	50992	51015	51038	51060	51083	51106	51129	51152	2	9
38	51174	51197	51220	51243	51265	51288	51311	51334	51356	51379	51402	51424	3	14
39	51447	51470	51492	51515	51538	51560	51583	51605	51628	51651	51673	51696	4	18
40	9.51718	51741	51763	51786	51808	51831	51853	51876	51898	51921	51943	51966	s	
41	51988	52011	52033	52056	52078	52100	52123	52145	52168	52190	52212	52235	1	4
42	52257	52279	52302	52324	52346	52369	52391	52413	52435	52458	52480	52502	2	9
43	52525	52547	52569	52591	52613	52636	52658	52680	52702	52724	52747	52769	3	13
44	52791	52813	52835	52857	52879	52901	52923	52946	52968	52990	53012	53034	4	18
45	9.53056	53078	53100	53122	53144	53166	53188	53210	53232	53254	53276	53298	s	
46	53320	53342	53364	53385	53407	53429	53451	53473	53495	53517	53539	53560	1	4
47	53582	53604	53626	53648	53670	53691	53713	53735	53757	53778	53800	53822	2	9
48	53844	53865	53887	53909	53931	53952	53974	53996	54017	54039	54061	54082	3	13
49	54104	54126	54147	54169	54190	54212	54234	54255	54277	54298	54320	54341	4	18
50	9.54363	54385	54406	54428	54449	54471	54492	54514	54535	54556	54578	54599	s	
51	54621	54642	54664	54685	54707	54728	54749	54771	54792	54813	54835	54856	1	4
52	54878	54899	54920	54941	54963	54984	55005	55027	55048	55069	55091	55112	2	9
53	55133	55154	55175	55197	55218	55239	55260	55282	55303	55324	55345	55366	3	13
54	55387	55409	55430	55451	55472	55493	55514	55535	55556	55577	55598	55619	4	17
55	9.55641	55662	55683	55704	55725	55746	55767	55788	55809	55830	55851	55872	s	
56	55893	55914	55934	55955	55976	55997	56018	56039	56060	56081	56102	56123	1	4
57	56144	56164	56185	56206	56227	56248	56269	56289	56310	56331	56352	56372	2	8
58	56393	56414	56435	56456	56476	56497	56518	56538	56559	56580	56601	56621	3	13
59	56642	56663	56683	56704	56725	56745	56766	56786	56807	56828	56848	56869	4	17

TABLE XVIII.

LOGARITHMS FOR FINDING THE APPARENT TIME OR HORARY ANGLE.

5 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P.	P.
0	9.56889	56910	56931	56951	56972	56992	57013	57033	57054	57074	57095	57115	s	
1	57136	57156	57177	57197	57218	57238	57259	57279	57299	57320	57340	57361	1	4
2	57381	57402	57422	57442	57463	57483	57503	57524	57544	57564	57585	57605	2	8
3	57625	57646	57666	57686	57706	57727	57747	57767	57787	57808	57828	57848	3	12
4	57868	57889	57909	57929	57949	57969	57990	58010	58030	58050	58070	58090	4	16
5	9.58110	58131	58151	58171	58191	58211	58231	58251	58271	58291	58311	58331	s	
6	58351	58371	58391	58411	58431	58451	58471	58491	58511	58531	58551	58571	1	4
7	58591	58611	58631	58651	58671	58691	58711	58731	58750	58770	58790	58810	2	8
8	58830	58850	58870	58889	58909	58929	58949	58969	58988	59008	59028	59048	3	12
9	59068	59087	59107	59127	59147	59166	59186	59206	59225	59245	59265	59285	4	16
10	9.59304	59324	59344	59363	59383	59403	59422	59442	59461	59481	59501	59520	s	
11	59540	59559	59579	59599	59618	59638	59657	59677	59696	59716	59735	59755	1	4
12	59774	59794	59813	59833	59852	59872	59891	59911	59930	59950	59969	59988	2	8
13	60008	60027	60047	60066	60085	60105	60124	60144	60163	60182	60202	60221	3	12
14	60240	60260	60279	60298	60318	60337	60356	60375	60395	60414	60433	60452	4	16
15	9.60472	60491	60510	60529	60549	60568	60587	60606	60625	60645	60664	60683	s	
16	60702	60721	60740	60760	60779	60798	60817	60836	60855	60874	60893	60912	1	4
17	60931	60951	60970	60989	61008	61027	61046	61065	61084	61103	61122	61141	2	8
18	61160	61179	61198	61217	61236	61255	61274	61293	61311	61330	61349	61368	3	11
19	61387	61406	61425	61444	61463	61482	61500	61519	61538	61557	61576	61595	4	15
20	9.61613	61632	61651	61670	61689	61708	61726	61745	61764	61783	61801	61820	s	
21	61839	61858	61876	61895	61914	61932	61951	61970	61988	62007	62026	62045	1	4
22	62063	62082	62100	62119	62138	62156	62175	62194	62212	62231	62249	62268	2	7
23	62287	62305	62324	62342	62361	62379	62398	62416	62435	62453	62472	62490	3	11
24	62509	62527	62546	62564	62583	62601	62620	62638	62657	62675	62693	62712	4	15
25	9.62730	62749	62767	62785	62804	62822	62841	62859	62877	62896	62914	62932	s	
26	62951	62969	62987	63006	63024	63042	63061	63079	63097	63115	63134	63152	1	4
27	63170	63188	63207	63225	63243	63261	63279	63298	63316	63334	63352	63370	2	7
28	63389	63407	63425	63443	63461	63479	63497	63516	63531	63552	63570	63588	3	11
29	63606	63624	63642	63660	63678	63696	63715	63733	63751	63769	63787	63805	4	15
30	9.63823	63841	63859	63877	63895	63913	63931	63949	63966	63985	64002	64020	s	
31	64038	64056	64074	64092	64110	64128	64146	64164	64181	64199	64217	64235	1	4
32	64253	64271	64289	64307	64324	64342	64360	64378	64395	64413	64431	64449	2	7
33	64467	64484	64502	64520	64538	64555	64573	64591	64609	64626	64644	64662	3	11
34	64679	64697	64715	64732	64750	64768	64785	64803	64821	64838	64856	64873	4	14
35	9.64891	64909	64926	64944	64962	64979	64997	65014	65032	65050	65067	65085	s	
36	65102	65120	65137	65155	65172	65190	65207	65225	65242	65260	65277	65295	1	3
37	65312	65330	65347	65365	65382	65399	65417	65434	65452	65469	65486	65504	2	7
38	65521	65539	65556	65573	65591	65608	65625	65643	65660	65677	65695	65712	3	10
39	65729	65747	65764	65781	65799	65816	65834	65850	65868	65885	65902	65919	4	14
40	9.65937	65954	65971	65988	66006	66023	66040	66057	66074	66092	66109	66126	s	
41	66143	66160	66177	66194	66212	66229	66246	66263	66280	66297	66314	66331	1	3
42	66348	66366	66383	66400	66417	66434	66451	66468	66485	66502	66519	66536	2	7
43	66553	66570	66587	66604	66621	66638	66655	66672	66689	66706	66723	66740	3	10
44	66757	66774	66791	66807	66824	66841	66858	66875	66892	66909	66926	66943	4	14
45	9.66959	66976	66993	67010	67027	67044	67060	67077	67094	67111	67128	67144	s	
46	67161	67178	67195	67212	67228	67245	67262	67279	67295	67312	67329	67346	1	3
47	67362	67379	67396	67412	67429	67446	67462	67479	67496	67512	67529	67546	2	7
48	67562	67579	67596	67612	67629	67646	67662	67679	67695	67712	67729	67745	3	10
49	67762	67778	67795	67811	67828	67844	67861	67878	67894	67911	67927	67944	4	13
50	9.67960	67977	67993	68010	68026	68042	68059	68075	68092	68108	68125	68141	s	
51	68158	68174	68190	68207	68223	68240	68256	68272	68289	68305	68322	68338	1	3
52	68354	68371	68387	68403	68420	68436	68452	68469	68485	68501	68517	68534	2	7
53	68550	68566	68583	68599	68615	68631	68648	68664	68680	68696	68713	68729	3	10
54	68745	68761	68777	68794	68810	68826	68842	68858	68874	68891	68907	68923	4	13
55	9.68939	68955	68971	68987	69004	69020	69036	69052	69068	69084	69100	69116	s	
56	69132	69148	69164	69181	69197	69213	69229	69245	69261	69277	69293	69309	1	3
57	69325	69341	69357	69373	69389	69405	69421	69437	69453	69469	69484	69500	2	6
58	69516	69532	69548	69564	69580	69596	69612	69628	69644	69660	69675	69691	3	10
59	69707	69723	69739	69755	69770	69786	69802	69818	69834	69850	69866	69881	4	13

TABLE XVIII.

LOGARITHMS FOR FINDING THE APPARENT TIME OR HORARY ANGLE.

6 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P.	P.
0	9.69897	69913	69929	69944	69960	69976	69992	70007	70023	70039	70055	70070	s	
1	70086	70102	70118	70133	70149	70165	70180	70196	70211	70227	70243	70259	1	3
2	70274	70290	70306	70321	70337	70353	70368	70384	70399	70415	70431	70446	2	6
3	70462	70477	70493	70509	70524	70540	70555	70571	70586	70602	70617	70633	3	9
4	70648	70664	70680	70695	70710	70726	70741	70757	70772	70788	70803	70819	4	12
5	9.70834	70850	70865	70881	70896	70911	70927	70942	70958	70973	70988	71004	s	
6	71019	71035	71050	71065	71081	71096	71111	71127	71142	71157	71173	71188	1	3
7	71203	71219	71234	71249	71265	71280	71295	71310	71326	71341	71356	71371	2	6
8	71387	71402	71417	71433	71448	71463	71478	71493	71509	71524	71539	71554	3	9
9	71569	71585	71600	71615	71630	71645	71660	71676	71691	71706	71721	71736	4	12
10	9.71751	71766	71781	71797	71812	71827	71842	71857	71872	71887	71902	71917	s	
11	71932	71947	71962	71977	71992	72007	72022	72037	72052	72067	72082	72097	1	3
12	72112	72127	72142	72157	72172	72187	72202	72217	72232	72247	72262	72277	2	6
13	72292	72307	72322	72337	72352	72366	72381	72396	72411	72426	72441	72456	3	9
14	72471	72485	72500	72515	72530	72545	72560	72574	72589	72604	72619	72634	4	12
15	9.72648	72663	72678	72693	72708	72722	72737	72752	72767	72781	72796	72811	s	
16	72825	72840	72855	72870	72884	72899	72914	72928	72943	72958	72972	72987	1	3
17	73002	73016	73031	73046	73060	73075	73090	73104	73119	73134	73148	73163	2	6
18	73177	73192	73207	73221	73236	73250	73265	73279	73294	73309	73323	73338	3	9
19	73352	73367	73381	73396	73410	73425	73439	73454	73468	73483	73497	73512	4	12
20	9.73526	73541	73555	73569	73584	73598	73613	73627	73642	73656	73671	73685	s	
21	73699	73714	73728	73743	73757	73771	73786	73800	73815	73829	73843	73858	1	3
22	73872	73886	73901	73915	73929	73944	73958	73972	73987	74001	74015	74029	2	6
23	74044	74058	74072	74087	74101	74115	74129	74144	74158	74172	74186	74200	3	9
24	74215	74229	74243	74257	74272	74286	74300	74314	74328	74342	74357	74371	4	12
25	9.74385	74399	74413	74427	74442	74456	74470	74484	74498	74512	74526	74540	s	
26	74551	74569	74583	74597	74611	74625	74639	74653	74667	74681	74695	74709	1	3
27	74723	74737	74751	74765	74779	74793	74807	74821	74835	74849	74863	74877	2	5
28	74891	74905	74919	74933	74947	74961	74975	74989	75003	75017	75031	75045	3	8
29	75059	75072	75086	75100	75114	75128	75142	75156	75170	75183	75197	75211	4	11
30	9.75225	75239	75253	75267	75280	75294	75308	75322	75336	75349	75363	75377	s	
31	75391	75405	75418	75432	75446	75460	75474	75487	75501	75515	75528	75542	1	3
32	75556	75570	75583	75597	75611	75625	75638	75652	75666	75679	75693	75707	2	5
33	75720	75734	75748	75761	75775	75789	75802	75816	75830	75843	75857	75870	3	8
34	75884	75898	75911	75925	75938	75952	75966	75979	75993	76006	76020	76033	4	10
35	9.76047	76060	76074	76088	76101	76115	76128	76142	76155	76169	76182	76196	s	
36	76209	76223	76236	76250	76263	76276	76290	76303	76317	76330	76344	76357	1	3
37	76371	76384	76397	76411	76424	76438	76451	76464	76478	76491	76505	76518	2	5
38	76531	76545	76558	76571	76585	76598	76611	76625	76638	76651	76665	76678	3	8
39	76691	76705	76718	76731	76745	76758	76771	76784	76798	76811	76824	76838	4	10
40	9.76851	76864	76877	76891	76904	76917	76930	76943	76957	76970	76983	76996	s	
41	77009	77023	77036	77049	77062	77075	77089	77102	77115	77128	77141	77154	1	3
42	77167	77181	77194	77207	77220	77233	77246	77259	77272	77285	77298	77312	2	5
43	77325	77338	77351	77364	77377	77390	77403	77416	77429	77442	77455	77468	3	8
44	77481	77494	77507	77520	77533	77546	77559	77572	77585	77598	77611	77624	4	10
45	9.77637	77650	77663	77676	77689	77702	77715	77728	77741	77754	77766	77779	s	
46	77792	77805	77818	77831	77844	77857	77870	77882	77895	77908	77921	77934	1	3
47	77947	77960	77972	77985	77998	78011	78024	78037	78049	78062	78075	78088	2	5
48	78101	78113	78126	78139	78152	78164	78177	78190	78203	78215	78228	78241	3	8
49	78254	78266	78279	78292	78305	78317	78330	78343	78355	78368	78381	78393	4	10
50	9.78406	78419	78431	78444	78457	78469	78482	78495	78507	78520	78533	78545	s	
51	78558	78570	78583	78596	78608	78621	78633	78646	78659	78671	78684	78696	1	2
52	78709	78721	78734	78747	78759	78772	78784	78797	78809	78822	78834	78847	2	5
53	78859	78872	78884	78897	78909	78922	78934	78947	78959	78972	78984	78997	3	7
54	79009	79021	79034	79046	79059	79071	79084	79096	79108	79121	79133	79146	4	10
55	9.79158	79170	79183	79195	79208	79220	79232	79245	79257	79269	79282	79294	s	
56	79306	79319	79331	79343	79356	79368	79380	79393	79405	79417	79430	79442	1	2
57	79454	79466	79479	79491	79503	79515	79528	79540	79552	79564	79577	79589	2	5
58	79601	79613	79626	79638	79650	79662	79674	79687	79699	79711	79723	79735	3	7
59	79748	79760	79772	79784	79796	79808	79821	79833	79845	79857	79869	79881	4	10

TABLE XVIII.

LOGARITHMS FOR FINDING THE APPARENT TIME OR HORARY ANGLE.

7 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P.	P.
0	9.79893	79905	79918	79930	79942	79954	79966	79978	79990	80002	80014	80026	s	
1	80038	80050	80063	80075	80087	80099	80111	80123	80135	80147	80159	80171	1	2
2	80183	80195	80207	80219	80231	80243	80255	80267	80279	80291	80303	80315	2	5
3	80327	80338	80350	80362	80374	80386	80398	80410	80422	80434	80446	80458	3	7
4	80470	80482	80494	80505	80517	80529	80541	80553	80565	80577	80588	80600	4	9
5	9.80612	80624	80636	80648	80660	80671	80683	80695	80707	80719	80730	80742	s	
6	80754	80766	80778	80789	80801	80813	80825	80836	80848	80860	80872	80883	1	2
7	80895	80907	80919	80930	80942	80954	80966	80977	80989	81001	81012	81024	2	5
8	81036	81047	81059	81071	81082	81094	81106	81117	81129	81141	81152	81164	3	7
9	81176	81187	81199	81211	81222	81234	81245	81257	81269	81280	81292	81303	4	9
10	9.81315	81326	81338	81350	81361	81373	81384	81396	81407	81419	81430	81442	s	
11	81454	81465	81477	81488	81500	81511	81523	81534	81546	81557	81569	81580	1	2
12	81592	81603	81614	81626	81637	81649	81660	81672	81683	81695	81706	81717	2	5
13	81729	81740	81752	81763	81775	81786	81797	81809	81820	81831	81843	81854	3	7
14	81866	81877	81888	81900	81911	81922	81934	81945	81956	81968	81979	81990	4	9
15	9.82002	82013	82024	82036	82047	82058	82070	82081	82092	82103	82115	82126	s	
16	82137	82148	82160	82171	82182	82193	82205	82216	82227	82238	82250	82261	1	2
17	82272	82283	82294	82306	82317	82328	82339	82350	82362	82373	82384	82395	2	4
18	82406	82417	82429	82440	82451	82462	82473	82484	82495	82507	82518	82529	3	7
19	82540	82551	82562	82573	82584	82595	82606	82618	82629	82640	82651	82662	4	9
20	9.82673	82684	82695	82706	82717	82728	82739	82750	82761	82772	82783	82794	s	
21	82805	82816	82827	82838	82849	82860	82871	82882	82893	82904	82915	82926	1	2
22	82937	82948	82959	82970	82981	82992	83003	83014	83025	83035	83046	83057	2	4
23	83068	83079	83090	83101	83112	83123	83134	83144	83155	83166	83177	83188	3	7
24	83199	83210	83220	83231	83242	83253	83264	83275	83285	83296	83307	83318	4	9
25	9.83329	83339	83350	83361	83372	83383	83393	83404	83415	83426	83436	83447	s	
26	83458	83469	83479	83490	83501	83512	83522	83533	83544	83555	83565	83576	1	2
27	83587	83597	83608	83619	83629	83640	83651	83662	83672	83683	83694	83704	2	4
28	83715	83725	83736	83747	83757	83768	83779	83789	83800	83811	83821	83832	3	7
29	83842	83853	83864	83874	83885	83895	83906	83916	83927	83938	83948	83959	4	9
30	9.83969	83980	83990	84001	84011	84022	84033	84043	84054	84064	84075	84085	s	
31	84096	84106	84117	84127	84138	84148	84159	84169	84179	84190	84200	84211	1	2
32	84221	84232	84242	84253	84263	84274	84284	84294	84305	84315	84326	84336	2	4
33	84346	84357	84367	84378	84388	84398	84409	84419	84430	84440	84450	84461	3	6
34	84471	84481	84492	84502	84512	84523	84533	84543	84554	84564	84574	84585	4	8
35	9.84595	84605	84616	84626	84636	84646	84657	84667	84677	84687	84698	84708	s	
36	84718	84729	84739	84749	84759	84769	84780	84790	84800	84810	84821	84831	1	2
37	84841	84851	84861	84872	84882	84892	84902	84912	84923	84933	84943	84953	2	4
38	84963	84973	84984	84994	85004	85014	85024	85034	85044	85054	85065	85075	3	6
39	85085	85095	85105	85115	85125	85135	85145	85155	85166	85176	85186	85196	4	8
40	9.85206	85216	85226	85236	85246	85256	85266	85276	85286	85296	85306	85316	s	
41	85326	85336	85346	85356	85366	85376	85386	85396	85406	85416	85426	85436	1	2
42	85446	85456	85466	85476	85486	85496	85506	85516	85526	85536	85546	85555	2	4
43	85565	85575	85585	85595	85605	85615	85625	85635	85645	85654	85664	85674	3	6
44	85684	85694	85704	85714	85724	85733	85743	85753	85763	85773	85783	85792	4	8
45	9.85802	85812	85822	85832	85841	85851	85861	85871	85881	85890	85900	85910	s	
46	85920	85930	85939	85949	85959	85969	85978	85988	85998	86008	86017	86027	1	2
47	86037	86046	86056	86066	86076	86085	86095	86105	86114	86124	86134	86143	2	4
48	86153	86163	86172	86182	86192	86201	86211	86221	86230	86240	86250	86259	3	6
49	86269	86279	86288	86298	86307	86317	86327	86336	86346	86356	86365	86375	4	8
50	9.86384	86394	86403	86413	86423	86432	86442	86451	86461	86470	86480	86489	s	
51	86499	86509	86518	86528	86537	86547	86556	86566	86575	86585	86594	86604	1	2
52	86613	86623	86632	86642	86651	86661	86670	86679	86689	86698	86708	86717	2	4
53	86727	86736	86746	86755	86764	86774	86783	86793	86802	86812	86821	86830	3	6
54	86840	86849	86858	86868	86877	86887	86896	86905	86915	86924	86933	86943	4	8
55	9.86952	86962	86971	86980	86990	86999	87008	87018	87027	87036	87045	87055	s	
56	87064	87073	87083	87092	87101	87111	87120	87129	87138	87148	87157	87166	1	2
57	87175	87185	87194	87203	87212	87222	87231	87240	87249	87259	87268	87277	2	4
58	87286	87295	87305	87314	87323	87332	87341	87351	87360	87369	87378	87387	3	6
59	87396	87406	87415	87424	87433	87442	87451	87460	87470	87479	87488	87497	4	8

TABLE XVIII.

LOGARITHMS FOR FINDING THE APPARENT TIME OR HORARY ANGLE.

8 Hours.

M.	0s.	5s.	10s.	15s.	20s.	25s.	30s.	35s.	40s.	45s.	50s.	55s.	P.	P.
0	9.87506	87515	87524	87534	87543	87552	87561	87570	87579	87588	87597	87606	s	
1	87615	87624	87633	87643	87652	87661	87670	87679	87688	87697	87706	87715	1	2
2	87724	87733	87742	87751	87760	87769	87778	87787	87796	87805	87814	87823	2	4
3	87832	87841	87850	87859	87868	87877	87886	87895	87904	87913	87921	87930	3	5
4	87939	87948	87957	87966	87975	87984	87993	88002	88011	88020	88029	88038	4	7
5	9.88046	88055	88064	88073	88082	88091	88100	88109	88117	88126	88135	88144	s	
6	88153	88162	88170	88179	88188	88197	88206	88215	88223	88232	88241	88250	1	2
7	88259	88268	88276	88285	88294	88303	88311	88320	88329	88338	88346	88355	2	4
8	88364	88373	88381	88390	88399	88408	88416	88425	88434	88443	88451	88460	3	5
9	88469	88478	88486	88495	88503	88512	88521	88530	88538	88547	88556	88565	4	7
10	9.88573	88582	88590	88599	88607	88616	88625	88634	88642	88651	88659	88668	s	
11	88677	88686	88694	88703	88711	88720	88728	88737	88745	88754	88763	88772	1	2
12	88780	88789	88797	88806	88814	88823	88831	88840	88848	88857	88865	88874	2	4
13	88882	88891	88899	88908	88916	88925	88933	88942	88950	88959	88967	88976	3	5
14	88984	88993	89001	89010	89018	89027	89035	89044	89052	89061	89069	89078	4	7
15	9.89086	89095	89103	89112	89120	89129	89137	89145	89153	89162	89170	89179	s	
16	89187	89196	89204	89213	89221	89229	89237	89246	89254	89263	89271	89279	1	2
17	89287	89296	89304	89313	89321	89330	89338	89346	89354	89363	89371	89379	2	4
18	89387	89396	89404	89413	89421	89429	89437	89446	89454	89462	89470	89479	3	5
19	89487	89495	89503	89512	89520	89528	89536	89545	89553	89561	89569	89577	4	7
20	9.89586	89596	89602	89611	89619	89627	89635	89643	89651	89660	89668	89676	s	
21	89684	89693	89701	89709	89717	89725	89733	89741	89749	89758	89766	89774	1	2
22	89782	89790	89798	89807	89815	89823	89831	89839	89847	89855	89863	89871	2	3
23	89879	89888	89896	89904	89912	89920	89928	89936	89944	89952	89960	89968	3	5
24	89976	89984	89992	90000	90008	90016	90024	90032	90040	90048	90056	90064	4	6
25	9.90072	90080	90088	90096	90104	90112	90120	90128	90136	90144	90152	90160	s	
26	90168	90176	90184	90192	90200	90208	90216	90224	90232	90240	90248	90256	1	2
27	90263	90271	90279	90287	90295	90303	90311	90319	90327	90335	90342	90350	2	3
28	90358	90366	90374	90382	90390	90398	90405	90413	90421	90429	90437	90445	3	5
29	90452	90460	90468	90476	90484	90492	90499	90507	90515	90523	90531	90539	4	6
30	9.90546	90554	90562	90570	90577	90585	90593	90601	90608	90616	90624	90632	s	
31	90639	90647	90655	90663	90670	90678	90686	90694	90701	90708	90717	90725	1	2
32	90732	90740	90747	90755	90763	90771	90778	90786	90794	90802	90809	90817	2	3
33	90824	90832	90840	90848	90855	90863	90870	90878	90885	90893	90901	90909	3	5
34	90916	90924	90931	90939	90946	90954	90962	90970	90977	90985	90992	91000	4	6
35	9.91007	91015	91022	91030	91037	91045	91052	91060	91067	91075	91083	91091	s	
36	91098	91106	91113	91121	91128	91136	91143	91151	91158	91166	91173	91181	1	2
37	91188	91196	91203	91211	91218	91226	91233	91241	91248	91255	91262	91270	2	3
38	91277	91285	91292	91300	91307	91315	91322	91330	91337	91345	91352	91360	3	5
39	91367	91374	91381	91389	91396	91404	91411	91419	91426	91433	91440	91448	4	6
40	9.91455	91463	91470	91478	91485	91492	91499	91507	91514	91522	91529	91536	s	
41	91543	91551	91558	91566	91573	91580	91587	91595	91602	91609	91616	91624	1	2
42	91631	91638	91645	91653	91660	91667	91674	91682	91689	91696	91703	91711	2	3
43	91718	91725	91732	91740	91747	91754	91761	91769	91776	91783	91790	91798	3	5
44	91805	91812	91819	91826	91833	91841	91848	91855	91862	91869	91876	91884	4	6
45	9.91891	91898	91905	91912	91919	91927	91934	91941	91948	91955	91962	91969	s	
46	91976	91984	91991	91998	92005	92012	92019	92026	92033	92040	92047	92054	1	1
47	92061	92069	92076	92083	92090	92097	92104	92111	92118	92125	92132	92139	2	3
48	92146	92153	92160	92167	92174	92181	92188	92195	92202	92209	92216	92223	3	4
49	92230	92237	92244	92251	92258	92265	92272	92279	92286	92293	92300	92307	4	6
50	9.92314	92321	92328	92335	92342	92349	92355	92362	92369	92376	92383	92390	s	
51	92397	92404	92411	92418	92425	92432	92438	92445	92452	92459	92466	92473	1	1
52	92480	92487	92493	92500	92507	92514	92521	92528	92534	92541	92548	92555	2	3
53	92562	92569	92575	92582	92589	92596	92603	92610	92616	92623	92630	92637	3	4
54	92643	92650	92657	92664	92670	92677	92684	92691	92698	92705	92711	92718	4	6
55	9.92725	92732	92738	92745	92751	92758	92765	92772	92778	92785	92792	92799	s	
56	92805	92812	92819	92826	92832	92839	92845	92852	92859	92866	92872	92879	1	1
57	92885	92892	92899	92906	92912	92919	92925	92932	92939	92946	92952	92959	2	3
58	92965	92972	92978	92985	92992	92999	93005	93012	93018	93025	93031	93038	3	4
59	93044	93051	93057	93064	93071	93078	93084	93091	93097	93104	93110	93117	4	6

TABLE XIX.

TO FIND THE LATITUDE BY AN ALTITUDE OF THE POLE STAR.

Subtracted if the R. A. is found in this column.				Correction.		*Added* if the R. A. is found in this column.			
H.	M.	H.	M.	°	'	H.	M.	H.	M.
7	10	19	10	0	0	7	10	19	10
7	00	19	20	0	3	7	20	19	00
6	50	19	30	0	7	7	30	18	50
6	40	19	40	1	11	7	40	18	40
6	30	19	50	0	15	7	50	18	30
6	20	20	00	0	18	8	00	18	20
6	10	20	10	0	21	8	10	18	10
6	00	20	20	0	25	8	20	18	00
5	50	20	30	0	29	8	30	17	50
5	40	20	40	0	32	8	40	17	40
5	30	20	50	0	36	8	50	17	30
5	20	21	00	0	39	9	00	17	20
5	10	21	10	0	42	9	10	17	10
5	00	21	20	0	45	9	20	17	00
4	50	21	30	0	48	9	30	16	50
4	40	21	40	0	51	9	40	16	40
4	30	21	50	0	54	9	50	16	30
4	20	22	00	0	56	10	00	16	20
4	10	22	10	0	59	10	10	16	10
4	00	22	20	1	02	10	20	16	00
3	50	22	30	1	04	10	30	15	50
3	40	22	40	1	06	10	40	15	40
3	30	22	50	1	08	10	50	15	30
3	20	23	00	1	10	11	00	15	20
3	10	23	10	1	13	11	10	15	10
2	50	23	30	1	17	11	30	14	50
2	30	23	50	1	19	11	50	14	30
2	10	0	10	1	21	12	10	14	10
1	40	0	40	1	23	12	40	13	40
1	10	1	10	1	24	13	10	13	10

TABLE XX.

AMPLITUDES.

DECLINATION.

Lat.	1°		2°		3°		4°		5°		6°		7°		8°		9°		10°		11°		12°		13°		14°	
°	°	′	°	′	°	′	°	′	°	′	°	′	°	′	°	′	°	′	°	′	°	′	°	′	°	′	°	′
1	1	0	2	0	3	0	4	0	5	0	6	0	7	0	8	0	9	0	10	0	11	0	12	0	13	0	14	0
3	1	0	2	0	3	0	4	0	5	0	6	0	7	1	8	1	9	1	10	1	11	1	12	1	13	1	14	1
5	1	0	2	0	3	1	4	1	5	1	6	1	7	2	8	2	9	2	10	2	11	3	12	3	13	3	14	3
7	1	0	2	1	3	1	4	2	5	2	6	3	7	3	8	4	9	4	10	5	11	5	12	5	13	6	14	6
9	1	1	2	1	3	2	4	3	5	4	6	5	7	5	8	6	9	7	10	8	11	8	12	9	13	10	14	11
10	1	1	2	2	3	3	4	4	5	5	6	6	7	6	8	8	9	9	10	10	11	11	12	11	13	12	14	13
11	1	1	2	2	3	3	4	4	5	6	6	7	7	7	8	9	9	10	10	11	11	13	12	13	13	15	14	16
12	1	1	2	3	3	4	4	5	5	7	6	8	7	9	8	11	9	12	10	13	11	15	12	16	13	18	14	19
13	1	2	2	3	3	5	4	6	5	8	6	10	7	11	8	13	9	14	10	16	11	18	12	19	13	21	14	23
14	1	2	2	4	3	6	4	7	5	9	6	11	7	13	8	15	9	17	10	19	11	20	12	22	13	24	14	26
15	1	2	2	4	3	6	4	8	5	11	6	13	7	15	8	17	9	19	10	21	11	24	12	26	13	28	14	30
16	1	2	2	5	3	7	4	10	5	12	6	15	7	17	8	19	9	22	10	24	11	27	12	29	13	32	14	35
17	1	3	2	5	3	8	4	11	5	14	6	17	7	19	8	22	9	25	10	28	11	31	12	33	13	36	14	39
18	1	3	2	6	3	9	4	12	5	15	6	19	7	22	8	25	9	28	10	31	11	34	12	38	13	41	14	44
19	1	3	2	7	3	10	4	14	5	17	6	21	7	24	8	28	9	31	10	35	11	39	12	42	13	46	14	49
20	1	4	2	8	3	12	4	15	5	19	6	23	7	27	8	31	9	35	10	39	11	43	12	47	13	51	14	55
21	1	4	2	9	3	13	4	17	5	21	6	26	7	30	8	34	9	39	10	43	11	48	12	52	13	57	15	1
22	1	5	2	9	3	14	4	19	5	24	6	28	7	33	8	38	9	43	10	48	11	53	12	57	14	2	15	7
23	1	5	2	10	3	16	4	21	5	26	6	31	7	36	8	42	9	47	10	52	11	58	13	3	14	9	15	14
24	1	6	2	11	3	17	4	23	5	28	6	34	7	40	8	46	9	52	10	57	12	3	13	9	14	15	15	21
25	1	6	2	12	3	19	4	25	5	31	6	37	7	44	8	50	9	56	11	3	12	9	13	16	14	22	15	29
26	1	7	2	14	3	20	4	27	5	34	6	41	7	48	8	54	10	1	11	8	12	15	13	22	14	30	15	37
27	1	7	2	15	3	22	4	29	5	37	6	44	7	52	8	59	10	7	11	14	12	22	13	30	14	37	15	45
28	1	8	2	16	3	24	4	32	5	40	6	48	7	56	9	4	10	12	11	21	12	29	13	37	14	46	15	54
29	1	9	2	17	3	26	4	34	5	43	6	52	8	1	9	9	10	18	11	27	12	36	13	45	14	54	16	3
30	1	9	2	19	3	28	4	37	5	47	6	56	8	5	9	15	10	24	11	34	12	44	13	53	15	3	16	13
31	1	10	2	20	3	30	4	40	5	50	7	0	8	10	9	21	10	31	11	41	12	52	14	2	15	13	16	24
32	1	11	2	22	3	32	4	43	5	54	7	5	8	16	9	27	10	38	11	49	13	0	14	11	15	23	16	34
33	1	12	2	23	3	35	4	46	5	58	7	10	8	21	9	33	10	45	11	57	13	9	14	21	15	34	16	46
34	1	12	2	25	3	37	4	50	6	2	7	15	8	27	9	40	10	53	12	5	13	18	14	31	15	45	16	58
35	1	13	2	27	3	40	4	53	6	6	7	20	8	33	9	47	11	1	12	14	13	28	14	42	15	56	17	11
36	1	14	2	28	3	43	4	57	6	11	7	25	8	40	9	54	11	9	12	24	13	39	14	54	16	9	17	21
37	1	15	2	30	3	45	5	1	6	16	7	31	8	47	10	2	11	18	12	33	13	49	15	5	16	22	17	38
38	1	16	2	32	3	48	5	5	6	21	7	37	8	54	10	10	11	27	12	44	14	1	15	18	16	35	17	53
39	1	17	2	34	3	52	5	9	6	26	7	44	9	1	10	19	11	37	12	55	14	13	15	31	76	50	18	8
40	1	18	2	37	3	55	5	13	6	32	7	51	9	9	10	28	11	47	13	6	14	25	15	45	17	5	18	25
41	1	20	2	39	3	59	5	18	6	38	7	58	9	18	10	38	11	58	13	18	14	39	15	59	17	20	18	42
42	1	21	2	42	4	2	5	23	6	44	8	5	9	26	10	48	12	9	13	31	14	53	16	15	17	37	19	0
43	1	22	2	44	4	6	5	28	6	51	8	13	9	36	10	58	12	21	13	44	15	7	16	31	17	55	19	19
44	1	23	2	47	4	10	5	34	6	58	8	21	9	45	11	9	12	34	13	58	15	23	16	48	18	13	19	39
45	1	25	2	50	4	15	5	40	7	5	8	30	9	55	11	21	12	47	14	13	15	39	17	6	18	33	20	0
46	1	26	2	53	4	19	5	46	7	12	8	39	10	6	11	33	13	1	14	29	15	57	17	25	18	54	20	23
47	1	28	2	56	4	24	5	52	7	21	8	49	10	18	11	46	13	16	14	45	16	15	17	45	19	16	20	47
48	1	30	2	59	4	29	5	59	7	29	8	59	10	30	12	0	13	31	15	2	16	34	18	6	19	39	21	12
49	1	31	3	3	4	35	6	6	7	38	9	10	10	42	12	15	13	48	15	21	16	54	18	29	20	3	21	38
50	1	33	3	7	4	40	6	14	7	48	9	22	10	56	12	30	14	5	15	40	17	16	18	52	20	29	22	7
51	1	35	3	11	4	46	6	22	7	58	9	34	11	10	12	47	14	24	16	1	17	39	19	17	20	57	22	36
52	1	37	3	15	4	53	6	30	8	8	9	47	11	25	13	4	14	43	16	23	18	3	19	44	21	26	23	8
53	1	40	3	19	4	59	6	39	8	20	10	0	11	41	13	22	15	4	16	46	18	29	20	13	21	57	23	42
54	1	42	3	24	5	7	6	49	8	32	10	15	11	58	13	42	15	26	17	11	18	57	20	43	22	30	24	18
55	1	45	3	29	5	14	6	59	8	44	10	30	12	16	14	3	15	50	17	37	19	26	21	15	23	5	24	57
56	1	47	3	35	5	22	7	10	8	58	10	46	12	35	14	25	16	15	18	5	19	57	21	50	23	43	25	38
57	1	50	3	40	5	31	7	22	9	13	11	4	12	56	14	48	16	42	18	36	20	30	22	26	24	24	26	22
58	1	53	3	47	5	40	7	34	9	28	11	23	13	18	15	14	17	10	19	8	21	6	23	6	25	7	27	10
59	1	57	3	53	5	50	7	47	9	45	11	43	13	41	15	41	17	41	19	42	21	45	23	49	25	54	28	1
60	2	0	4	0	6	0	8	1	10	2	12	4	14	6	16	10	18	14	20	19	22	26	24	34	26	44	28	56
61	2	4	4	8	6	12	8	16	10	21	12	27	14	34	16	41	18	49	20	59	23	11	25	24	27	39	29	56
62	2	8	4	16	6	24	8	33	10	42	12	52	15	3	17	15	19	28	21	42	23	59	26	17	28	38	31	1
63	2	12	4	25	6	37	8	50	11	4	13	19	15	34	17	51	20	9	22	29	24	51	27	15	29	42	32	12
64	2	17	4	34	6	51	9	9	11	28	13	48	16	8	18	31	20	54	23	20	25	48	28	19	30	52	33	30
65	2	22	4	44	7	7	9	30	11	54	14	19	16	46	19	14	21	44	24	16	26	50	29	28	32	10	34	55
66	2	28	4	55	7	24	9	53	12	22	14	54	17	26	20	1	22	37	25	16	27	59	30	45	33	35	36	30

TABLE XX.

AMPLITUDES.

DECLINATION.

Lat.	15°	16°	17°	18°	19°	20°	21°	21° 30′	22°	22° 30′	23°	23° 28′
°	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
1	15 0	16 0	17 0	18 0	19 0	20 0	21 0	21 30	22 0	22 30	23 0	23 28
3	15 1	16 1	17 1	18 2	19 2	20 2	21 2	21 32	22 2	22 32	23 2	23 30
5	15 4	16 4	17 4	18 4	19 5	20 5	21 5	21 35	22 5	22 35	23 6	23 34
7	15 7	16 7	17 8	18 8	19 9	20 9	21 10	21 40	22 10	22 41	23 11	23 39
9	15 11	16 12	17 13	18 14	19 15	20 16	21 16	21 47	22 17	22 48	23 18	23 47
10	15 14	16 15	17 16	18 17	19 18	20 19	21 20	21 51	22 21	22 52	23 23	23 51
11	15 17	16 18	17 20	18 21	19 22	20 24	21 25	21 55	22 26	22 57	23 28	23 56
12	15 21	16 22	17 23	18 25	19 26	20 28	21 30	22 0	22 31	23 2	23 33	24 1
13	15 24	16 26	17 28	18 29	19 31	20 33	21 35	22 6	22 37	23 8	23 38	24 7
14	15 28	16 30	17 32	18 34	19 36	20 38	21 40	22 11	22 43	23 14	23 45	24 14
15	15 33	16 35	17 37	18 39	19 42	20 44	21 47	22 18	22 49	23 20	23 52	24 21
16	15 37	16 40	17 42	18 45	19 48	20 51	21 53	22 25	22 56	23 28	23 59	24 28
17	15 42	16 45	17 48	18 51	19 54	20 57	22 1	22 32	23 4	23 35	24 7	24 36
18	15 47	16 51	17 54	18 58	20 1	21 5	22 8	22 40	23 12	23 44	24 15	24 45
19	15 53	16 57	18 1	19 5	20 8	21 12	22 16	22 49	23 20	23 52	24 25	24 54
20	15 59	17 3	18 8	19 12	20 16	21 21	22 25	22 57	23 30	24 2	24 34	25 4
21	16 6	17 10	18 15	19 20	20 25	21 29	22 31	23 7	23 39	24 12	24 45	25 15
22	16 13	17 18	18 23	19 28	20 33	21 39	22 44	23 17	23 50	24 23	24 55	25 26
23	16 20	17 25	18 31	19 37	20 43	21 49	22 55	23 28	24 1	24 34	25 7	25 38
24	16 27	17 34	18 40	19 46	20 53	21 59	23 6	23 39	24 13	24 46	25 19	25 51
25	16 36	17 42	18 49	19 56	21 3	22 10	23 18	23 51	24 25	24 59	25 32	26 4
26	16 44	17 52	18 59	20 7	21 14	22 22	23 30	24 4	24 38	25 12	25 46	26 18
27	16 53	18 1	19 9	20 18	21 26	22 34	23 43	24 17	24 52	25 26	26 1	26 33
28	17 3	18 11	19 20	20 29	21 38	22 47	23 57	24 31	25 6	25 41	26 16	26 49
29	17 13	18 22	19 32	20 41	21 51	23 1	24 11	24 46	25 22	25 57	26 32	27 5
30	17 23	18 34	19 44	20 54	22 5	23 16	24 27	25 2	25 38	26 13	26 49	27 23
31	17 34	18 45	19 57	21 8	22 19	23 31	24 43	25 19	25 55	26 31	27 7	27 41
32	17 46	18 58	20 10	21 22	22 35	23 47	25 0	25 36	26 13	26 49	27 26	28 0
33	17 59	19 11	20 24	21 37	22 51	24 4	25 18	25 55	26 32	27 9	27 46	28 21
34	18 11	19 25	20 39	21 53	23 7	24 22	25 37	26 14	26 52	27 29	28 7	28 42
35	18 25	19 40	20 55	22 10	23 25	24 41	25 57	26 35	27 13	27 51	28 29	29 5
36	18 39	19 55	21 11	22 27	23 44	25 1	26 18	26 56	27 35	28 14	28 53	29 30
37	18 55	20 11	21 28	22 46	24 3	25 21	26 40	27 19	27 58	28 38	29 17	29 55
38	19 10	20 28	21 47	23 5	24 24	25 43	27 3	27 43	28 23	29 3	29 44	30 21
39	19 27	20 46	22 6	23 26	24 46	26 7	27 28	28 8	28 49	29 30	30 11	30 49
40	19 45	21 5	22 26	23 47	25 9	26 31	27 54	28 35	29 17	29 58	30 40	31 19
41	20 3	21 25	22 48	24 10	25 33	26 57	28 21	29 3	29 46	30 28	31 11	31 51
42	20 23	21 46	23 10	24 34	25 59	27 24	28 50	29 33	30 16	31 0	31 43	32 24
43	20 44	22 8	23 34	25 0	26 26	27 53	29 20	30 5	30 49	31 33	32 18	32 59
44	21 5	22 32	23 59	25 26	26 55	28 23	29 53	30 38	31 23	32 8	32 54	33 37
45	21 28	22 57	24 25	25 55	27 25	28 56	30 27	31 13	31 59	32 46	33 33	34 17
46	21 53	23 23	24 53	26 25	27 57	29 30	31 3	31 51	32 38	33 26	34 14	34 59
47	22 18	23 50	25 23	26 57	28 31	30 6	31 42	32 30	33 19	34 8	34 57	35 44
48	22 45	24 20	25 55	27 30	29 7	30 44	32 23	33 13	34 3	34 58	35 44	36 31
49	23 14	24 51	26 28	28 6	29 45	31 25	33 7	33 58	34 49	35 41	36 33	37 22
50	23 45	25 24	27 3	28 44	30 26	32 9	33 53	34 46	35 39	36 32	37 26	38 17
51	24 17	25 59	27 41	29 25	31 9	32 55	34 43	35 37	36 32	37 27	38 23	39 15
52	24 52	26 36	28 21	30 8	31 56	33 45	35 36	36 32	37 29	38 26	39 24	40 18
53	25 28	27 16	29 4	30 54	32 45	34 38	36 33	37 31	38 30	39 29	40 29	41 26
54	26 7	27 58	29 50	31 43	33 38	35 35	37 34	38 34	39 36	40 37	41 40	42 39
55	26 49	28 43	30 39	32 36	34 35	36 36	38 40	39 43	40 47	41 51	42 56	43 58
56	27 34	29 32	31 31	33 33	35 36	37 42	39 51	40 57	42 4	43 11	44 20	45 24
57	28 22	30 24	32 28	34 34	36 43	38 54	41 9	42 18	43 27	44 38	45 50	46 59
58	29 14	31 21	33 29	35 40	37 54	40 12	42 33	43 45	44 59	46 14	47 30	48 43
59	30 10	32 21	34 35	36 52	39 12	41 37	44 6	45 22	46 40	47 59	49 21	50 38
60	31 10	33 27	35 47	38 10	40 38	43 10	45 47	47 8	48 31	49 56	51 24	52 47
61	32 16	34 39	37 5	39 36	42 11	44 52	47 40	49 7	50 36	52 7	53 42	55 13
62	33 27	35 57	38 31	41 10	43 54	46 46	49 46	51 19	52 56	54 36	56 20	58 1
63	34 45	37 23	40 5	42 54	45 49	48 53	52 8	53 50	55 36	57 27	59 23	61 18
64	36 11	38 58	41 50	44 49	47 58	51 17	54 50	56 44	58 43	60 48	63 2	65 17
65	37 46	40 43	43 46	46 59	50 23	54 2	57 59	60 8	62 25	64 53	67 36	70 26
66	39 31	42 40	45 57	49 27	53 10	57 14	61 46	64 18	67 4	70 12	73 52	78 15

CALENDAR FOR 1878.

TABLE XXI.

JANUARY, 1878.—Page 1.

AT APPARENT NOON.

Day of the Week.	Day of the Month.	THE SUN'S RIGHT ASCENSION AND DECLINATION.				Equation of Time, *to be added to Apparent Time.*	Var. in 1 hour.
		Apparent Right Ascension	Var. in 1 hour.	*Apparent* Declination.	Var. in 1 hour.		
		h. m. s.	s.	° ′ ″	″	m. s.	s.
Tuesday .	1	18 47 53.62	11.045	S. 23 0 2.1	12.64	3 52.25	1.185
Wednes'y	2	18 52 18.53	11.030	22 54 45.0	13.78	4 20.52	1.171
Thursday	3	18 56 43.08	11.015	22 49 0.5	14.92	4 48.44	1.155
Friday . . .	4	19 1 7.24	10.998	22 42 48.7	16.05	5 15.96	1.138
Saturday .	5	19 5 30.97	10.979	22 36 9.9	17.18	5 43.06	1.119
Sunday . .	6	19 9 54.23	10.959	22 29 4.2	18.29	6 9.69	1.100
Monday .	7	19 14 17.01	10.938	22 21 31.9	19.40	6 35.84	1.079
Tuesday .	8	19 18 39.26	10.916	22 13 33.2	20.49	7 1.46	1.056
Wednes'y	9	19 23 0.96	10.892	22 5 8.4	21.57	7 26.54	1.033
Thursday	10	19 27 22.09	10.868	21 56 17.7	22.65	7 51.05	1.009
Friday . . .	11	19 31 42.63	10.843	21 47 1.4	23.71	8 14.95	0.983
Saturday .	12	19 36 2.54	10.816	21 37 19.7	24.76	8 38.24	0.957
Sunday . .	13	19 40 21.81	10.789	21 27 13.0	25.80	9 0.89	0.930
Monday .	14	19 44 40.41	10.761	21 16 41.5	26.83	9 22.88	0.902
Tuesday .	15	19 48 58.34	10.732	21 5 45.6	27.83	9 44.19	0.873
Wednes'y	16	19 53 15.57	10.703	20 54 25.6	28.83	10 4.80	0.844
Thursday	17	19 57 32.08	10.673	20 42 41.7	29.82	10 24.71	0.814
Friday . . .	18	20 1 47.87	10.643	20 30 34.4	30.79	10 43.89	0.784
Saturday .	19	20 6 2.93	10.612	20 18 3.9	31.75	11 2.33	0.753
Sunday . .	20	20 10 17.24	10.581	20 5 10.5	32.69	11 20.04	0.722
Monday .	21	20 14 30.80	10.549	19 51 54.6	33.62	11 36.99	0.690
Tuesday .	22	20 18 43.59	10.517	19 38 16.6	34.54	11 53.18	0.659
Wednes'y	23	20 22 55.62	10.485	19 24 16.6	35.45	12 8.61	0.627
Thursday	24	20 27 6.88	10.453	19 9 55.0	36.34	12 23.28	0.595
Friday . . .	25	20 31 17.37	10.421	18 55 12.3	37.21	12 37.17	0.562
Saturday .	26	20 35 27.07	10.388	18 40 8.7	38.07	12 50.27	0.530
Sunday . .	27	20 39 35.98	10.355	18 24 44.7	38.92	13 2.59	0.497
Monday .	28	20 43 44.10	10.321	18 9 0.6	39.75	13 14.12	0.464
Tuesday .	29	20 47 51.41	10.288	17 52 56.9	40.55	13 24.85	0.430
Wednes'y	30	20 51 57.91	10.254	17 36 34.1	41.34	13 34.77	0.396
Thursday	31	20 56 3.59	10.220	17 19 52.4	42.12	13 43.87	0.362

TABLE XXI.

JANUARY, 1878.—Page 2.

AT MEAN NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination.			Equation of Time, *to be subtracted from Mean Time.*
		Apparent Right Ascension	*Apparent* Declination.	Semi-diameter.	
		h. m. s.	° ′ ″	′ ″	m. s.
Tuesday	1	18 47 52.91	S. 23 0 2.9	16 18.2	3 52.17
Wednesday	2	18 52 17.73	22 54 46.0	16 18.2	4 20.44
Thursday	3	18 56 42.20	22 49 1.7	16 18.2	4 48.35
Friday	4	19 1 6.27	22 42 50.1	16 18.2	5 15.86
Saturday	5	19 5 29.92	22 36 11.5	16 18.2	5 42.95
Sunday	6	19 9 53.11	22 29 6.1	16 18.1	6 9.58
Monday	7	19 14 15.81	22 21 34.1	16 18.1	6 35.72
Tuesday	8	19 18 37.98	22 13 35.6	16 18.1	7 1.34
Wednesday	9	19 22 59.61	22 5 11.1	16 18.0	7 26.41
Thursday	10	19 27 20.67	21 56 20.7	16 18.0	7 50.91
Friday	11	19 31 41.14	21 47 4.6	16 18.0	8 14.82
Saturday	12	19 36 0.98	21 37 23.3	16 17.9	8 38.10
Sunday	13	19 40 20.19	21 27 16.9	16 17.9	9 0.75
Monday	14	19 44 38.73	21 16 45.7	16 17.8	9 22.73
Tuesday	15	19 48 56.60	21 5 50.1	16 17.8	9 44.04
Wednesday	16	19 53 13.77	20 54 30.4	16 17.7	10 4 66
Thursday	17	19 57 30.23	20 42 46.9	16 17.6	10 24.56
Friday	18	20 1 45.97	20 30 39.9	16 17.5	10 43.75
Saturday	19	20 6 0.98	20 18 9.8	16 17.4	11 2.20
Sunday	20	20 10 15.24	20 5 16.7	16 17.3	11 19.90
Monday	21	20 14 28.76	19 52 1.1	16 17.2	11 36.85
Tuesday	22	20 18 41.51	19 38 23.4	16 17.1	11 53.05
Wednesday	23	20 22 53.50	19 24 23.8	16 17.0	12 8 49
Thursday	24	20 27 4.72	19 10 2.5	16 16.9	12 23.16
Friday	25	20 31 15.17	18 55 20.1	16 16.8	12 37.05
Saturday	26	20 35 24.84	18 40 16.8	16 16.6	12 50.16
Sunday	27	20 39 33.73	18 24 53.1	16 16.5	13 2.49
Monday	28	20 43 41.82	18 9 9.4	16 16.4	13 14.02
Tuesday	29	20 47 49.11	17 53 6.0	16 16.2	13 24.75
Wednesday	30	20 51 55.59	17 36 43.5	16 16.1	13 34.68
Thursday	31	20 56 1.26	17 20 2.1	16 15.9	13 43.79

TABLE XXI.

FEBRUARY, 1878.—Page 1.

AT APPARENT NOON.

Day of the Week.	Day of the Month.	THE SUN'S RIGHT ASCENSION AND DECLINATION.				Equation of Time *to be added to Apparent Time.*	Var. in 1 hour.
		Apparent Right Ascension	Var. in 1 hour.	*Apparent* Declination.	Var. in 1 hour.		
		h. m. s.	s.	° ′ ″	″	m. s.	s.
Friday...	1	21 0 8.46	10·186	S. 17 2 52.3	42.88	13 52.16	0.328
Saturday.	2	21 4 12.50	10.151	16 45 34.4	43.61	13 59.62	0.294
Sunday ..	3	21 8 15.71	10.116	16 27 58.9	44.34	14 6.26	0.259
Monday .	4	21 12 18.09	10.082	16 10 6.2	45.04	14 12.07	0.225
Tuesday .	5	21 16 19.65	10.048	15 51 56.9	45.73	14 17.06	0.191
Wednes'y	6	21 20 20.38	10.013	15 33 31.3	46.39	14 21.22	0.156
Thursday	7	21 24 20.29	9.979	15 14 50.0	47.04	14 24.56	0.122
Friday...	8	21 28 19.38	9.945	14 55 53.3	47.68	14 27.09	0.089
Saturday.	9	21 32 17.66	9.912	14 36 41.6	48.69	14 28.82	0.055
Sunday ..	10	21 36 15.14	9.879	14 17 15.4	48.88	14 29.74	0.022
Monday .	11	21 40 11.83	9.846	13 57 35.0	49.47	14 29.87	0.011
Tuesday .	12	21 44 7.73	9.813	13 37 41.0	50.03	14 29.21	0.044
Wednes'y	13	21 48 2.85	9.781	13 17 33.8	50.57	14 27.78	0.076
Thursday	14	21 51 57.20	9.749	12 57 13.8	51.09	14 25.58	0.107
Friday...	15	21 55 50.80	9.718	12 36 41.3	51.60	14 22.63	0.138
Saturday.	16	21 59 43.66	9.688	12 15 56.8	52.10	14 18 95	0 168
Sunday ..	17	22 3 35.81	9.658	11 55 0.7	52.58	14 14.55	0.198
Monday .	18	22 7 27.25	9.629	11 33 53.2	53.04	14 9.45	0.227
Tuesday .	19	22 11 18.00	9.601	11 12 34.9	53.48	14 3.67	0.225
Wednes'y	20	22 15 8.09	9.574	10 51 6.1	53.91	13 57.22	0.282
Thursday	21	22 18 57.53	9.547	10 29 27.0	54.33	13 50.13	0.308
Friday...	22	22 22 46.35	9.521	10 7 38.2	54.73	13 42.42	0.334
Saturday.	23	22 26 34.57	9.496	9 45 39.9	55.11	13 34.10	0.359
Sunday ..	24	22 30 22.19	9.472	9 23 32.7	55.48	13 25.19	0.383
Monday .	25	22 34 9.24	9.449	9 1 16.9	55.83	13 15.71	0.407
Tuesday .	26	22 37 55.72	9.425	8 38 53.0	56.16	13 5.67	0.430
Wednes'y	27	22 41 41.66	9.403	8 16 21.3	56.47	12 55.08	0.452
Thursday	28	22 45 27.07	9.381	7 53 42.3	56.77	12 43.96	0.474

TABLE XXI.

FEBRUARY, 1878.—**Page 2.**

AT MEAN NOON.

Day of the Week.	Day of the Month.	THE SUN'S RIGHT ASCENSION AND DECLINATION.			Equation of Time, *to be subtracted from Mean Time.*
		Apparent Right Ascension	*Apparent* Declination.	Semi-diameter.	
		h. m. s.	° ′ ″	′ ″	m. s.
Friday......	1	21 0 6.10	S. 17 3 2.3	16 15.8	13 52 08
Saturday....	2	21 4 10.13	16 45 44.5	16 15.6	13 59.55
Sunday	3	21 8 13.33	16 28 9.3	16 15.5	14 6.19
Monday	4	21 12 15.71	16 10 16.9	16 15.3	14 12.01
Tuesday	5	21 16 17.26	15 52 7.8	16 15.2	14 17.01
Wednesday .	6	21 20 17.99	15 33 42.4	16 15.0	14 21.18
Thursday ...	7	21 24 17.90	15 15 1.3	16 14.8	14 24.53
Friday....	8	21 28 16.99	14 56 4.7	16 14.7	14 27.07
Saturday....	9	21 32 15.27	14 36 53.2	16 14.5	14 28.80
Sunday	10	21 36 12.76	14 17 27.2	16 14.3	14 29.73
Monday	11	21 40 9.45	13 57 47.0	16 14.1	14 29.87
Tuesday	12	21 44 5.36	13 37 53.1	16 13.9	14 29.92
Wednesday .	13	21 48 0.49	13 17 46.0	16 13.7	14 27.80
Thursday ...	14	21 51 54.86	12 57 26.0	16 13.6	14 25.61
Friday......	15	21 55 48.47	12 36 53.6	16 13.4	14 22.67
Saturday....	16	21 59 41.35	12 16 9.2	16 13.2	14 18.99
Sunday	17	22 3 33.51	11 55 13.2	16 13.0	14 14.60
Monday.....	18	22 7 24.97	11 34 5.8	16 12.7	14 9.50
Tuesday	19	22 11 15.75	11 12 47.5	16 12.5	14 3.72
Wednesday .	20	22 15 5.86	10 51 18.6	16 12.3	13 57.28
Thursday ...	21	22 18 55.33	10 29 39.5	16 12.1	13 50.20
Friday......	22	22 22 44.18	10 7 50.7	16 11.8	13 42.49
Saturday ...	23	22 26 32.42	9 45 52.4	16 11.6	13 34.18
Sunday	24	22 30 20.07	9 23 45.1	16 11.4	13 25.28
Monday	25	22 34 7.15	9 1 29.2	16 11.1	13 15.80
Tuesday	26	22 37 53.67	8 39 5.2	16 10.9	13 5.76
Wednesday .	27	22 41 39.64	8 16 33.5	16 10.6	12 55.18
Thursday ...	28	22 45 25.08	7 53 54.4	16 10.4	12 44.07

TABLE XXI.

MARCH, 1878.—**Page 1.**

AT APPARENT NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination.				Equation of Time, *to be added to Apparent Time.*	Var. in 1 hour.
		Apparent Right Ascension	Var. in 1 hour.	*Apparent* Declination.	Var. in 1 hour.		
		h. m. s.	s.	° ′ ″	″	m. s.	s.
Friday . . .	1	22 49 11.96	9.360	S. 7 30 56.4	57.05	12 32.33	0.495
Saturday .	2	22 52 56.35	9.339	7 8 4.0	57.31	12 20.20	0.516
Sunday . .	3	22 56 40.25	9.319	6 45 5.6	57.55	12 7.58	0.536
Monday .	4	23 0 23.68	9.300	6 22 1.5	57.78	11 54.49	0.555
Tuesday	5	23 4 6.66	9.282	5 58 52.2	57.99	11 40.95	0.573
Wednes'y	6	23 7 49.20	9.264	5 35 38.0	58.18	11 26.98	0.591
Thursday	7	23 11 31.32	9.247	5 12 19.4	58.36	11 12.58	0.608
Friday . . .	8	23 15 13.04	9.230	4 48 56.8	58.52	10 57.79	0.624
Saturday .	9	23 18 54.37	9.215	4 25 30.5	58.66	10 42.61	0.640
Sunday . .	10	23 22 35.34	9.200	4 2 1.0	58.79	10 27.07	0.655
Monday .	11	23 26 15.97	9.186	3 38 28.7	58.90	10 11.19	0.669
Tuesday	12	23 29 56.26	9.172	3 14 53.9	58.99	9 54.97	0.682
Wednes'y	13	23 33 36.24	9.160	2 51 17.0	59.07	9 38.45	0.695
Thursday	14	23 37 15.94	9.148	2 27 38.4	59 13	9 21.63	0.706
Friday . . .	15	23 40 55.36	9.137	2 3 58.6	59.18	9 4.55	0.717
Saturday .	16	23 44 34.53	9.127	1 40 17.7	59.22	8 47.22	0.727
Sunday . .	17	23 48 13 48	9.119	1 16 36.2	59 24	8 29.66	0.736
Monday .	18	23 51 52.23	9.111	0 52 54.4	59.24	8 11.90	0.744
Tuesday .	19	23 55 30.80	9.104	0 29 12.6	59.23	7 53.97	0.750
Wednes'y	20	23 59 9.23	9.099	S. 0 5 31.2	59.21	7 35.89	0.756
Thursday	21	0 2 47.54	9.094	N. 0 18 9.6	59.18	7 17.70	0.760
Friday . . .	22	0 6 25.75	9.091	0 41 49.5	59.14	6 59.41	0.764
Saturday .	23	0 10 3.89	9.088	1 5 28.1	59.08	6 41.05	0.766
Sunday . .	24	0 13 41.99	9.087	1 29 5.1	59.00	6 22.64	0.768
Monday .	25	0 17 20.05	9.086	1 52 40.0	58.90	6 4.20	0.769
Tuesday .	26	0 20 58.10	9.086	2 16 12.5	58.80	5 45.75	0.769
Wednes'y	27	0 24 36.16	9.086	2 39 42.3	58.68	5 27.31	0.768
Thursday	28	0 28 14.25	9.088	3 3 9.0	58.54	5 8.89	0.766
Friday . . .	29	0 31 52.38	9.090	3 26 32.2	58.39	4 50.52	0.764
Saturday .	30	0 35 30.58	9.093	3 49 51.6	58.22	4 32.21	0.761
Sunday .	31	0 39 8.85	9.097	4 13 6.7	58.03	4 13.98	0.757

TABLE XXI.

MARCH, 1878.—**Page 2.**

AT MEAN NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination. Apparent Right Ascension.	The Sun's Right Ascension and Declination. Apparent Declination.	The Sun's Right Ascension and Declination. Semi-diameter.	Equation of Time, *to be subtracted from Mean Time.*
		h. m. s.	° ′ ″	′ ″	m. s.
Friday.....	1	22 49 10.00	S. 7 31 8.3	16 10.1	12 32.44
Saturday....	2	22 52 54.43	7 8 15.8	16 9.9	12 20.31
Sunday	3	22 56 38.37	6 45 17.2	16 9.6	12 7.69
Monday	4	23 0 21.83	6 22 13.0	16 9.4	11 54.60
Tuesday .	5	23 4 4.85	5 59 3.5	16 9.1	11 41.06
Wednesday .	6	23 7 47.43	5 35 49.1	16 8.9	11 27.09
Thursday ...	7	23 11 29.59	5 12 30.3	16 8.6	11 12.69
Friday......	8	23 15 11.35	4 49 7.5	16 8.4	10 57.90
Saturday....	9	23 18 52.73	4 25 41.0	16 8.1	10 42.73
Sunday	10	23 22 33.74	4 2 11.3	16 7.9	10 27.19
Monday	11	23 26 14.41	3 38 38.7	16 7.6	10 11 30
Tuesday	12	23 29 54.74	3 15 3.6	16 7.3	9 55.08
Wednesday	13	23 33 34.77	2 51 26.5	16 7.1	9 38.56
Thursday ...	14	23 37 14.51	2 27 47.7	16 6.8	9 21.74
Friday.....	15	23 40 53.98	2 4 7.5	16 6.5	9 4.66
Saturday....	16	23 44 33.20	1 40 26.4	16 6.3	8 47 32
Sunday	17	23 48 12.19	1 16 44.6	16 6.0	8 29.76
Monday	18	23 51 50.98	0 53 2.5	16 5.7	8 12.00
Tuesday	19	23 55 29.60	0 29 20.4	16 5.5	7 54.07
Wednesday .	20	23 59 8.08	S. 0 5 38.7	16 5.2	7 35.99
Thursday ...	21	0 2 46.43	N. 0 18 2.4	16 4.9	7 17.79
Friday....	22	0 6 24.69	0 41 42.6	16 4.7	6 59.50
Saturday....	23	0 10 2.88	1 5 21.5	16 4.4	6 41 13
Sunday	24	0 13 41.02	1 28 58.8	16 4.1	6 22.72
Monday	25	0 17 19.13	1 52 34.1	16 3.8	6 4.27
Tuesday	26	0 20 57.23	2 16 6.9	16 3.5	5 45 82
Wednesday .	27	0 24 35.34	2 39 37.0	16 3.2	5 27.38
Thursday ...	28	0 28 13.47	3 3 4.0	16 3.0	5 8.96
Friday......	29	0 31 51.65	3 26 27.5	16 2.7	4 50.58
Saturday....	30	0 35 29.89	3 49 47.2	16 2.4	4 32.27
Sunday	31	0 39 8.21	4 13 2.6	16 2.1	4 14.04

TABLE XXI.

APRIL, 1878.—**Page 1.**

AT APPARENT NOON.

Day of the Week.	Day of the Month.	THE SUN'S RIGHT ASCENSION AND DECLINATION.				Equation of Time *to be added to* / *subt. from* *Apparent Time.*	Var. in 1 hour.
		Apparent Right Ascension	Var. in 1 hour.	*Apparent* Declination.	Var. in 1 hour.		
		h. m. s.	s.	° ′ ″	″	m. s.	s.
Monday .	1	0 42 47.23	9·101	N. 4 36 17.2	57.84	3 55.85	0.753
Tuesday .	2	0 46 25.72	9.106	4 59 22.8	57.62	3 37.84	0.748
Wednes'y	3	0 50 4.34	9.112	5 22 23.1	57.39	3 19.95	0.742
Thursday	4	0 53 43.11	9.119	5 45 17.7	57.15	3 2.22	0.735
Friday . . .	5	0 57 22.04	9.126	6 8 6.2	56.89	2 44.65	0.728
Saturday .	6	1 1 1.16	9.134	6 30 48.3	56.61	2 27.26	0.720
Sunday . .	7	1 4 40.47	9.143	6 53 23.7	56.33	2 10.07	0.712
Monday .	8	1 8 20.00	9.152	7 15 52.0	56.02	1 53.08	0.703
Tuesday .	9	1 11 59.75	9.161	7 38 12.8	55.70	1 36.33	0.693
Wednes'y	10	1 15 39.74	9.172	8 0 25.7	55.36	1 19.81	0.683
Thursday	11	1 19 19.99	9.182	8 22 30.4	55.02	1 3.55	0.672
Friday . . .	12	1 23 0.50	9.194	8 44 26.7	54.66	0 47.55	0.661
Saturday .	13	1 26 41.30	9.206	9 6 14.1	54.29	0 31.84	0.648
Sunday . .	14	1 30 22.41	9.220	9 27 52.4	53.90	0 16.44	0.635
Monday .	15	1 34 3.84	9.234	9 49 21.2	53.50	0 1.36	0.621
Tuesday .	16	1 37 45.62	9.249	10 10 40 2	53.08	0 13 38	0 606
Wednes'y	17	1 41 27.77	9.264	10 31 49.2	52.66	0 27.75	0.591
Thursday	18	1 45 10.30	9.281	10 52 47.8	52.22	0 41.73	0.574
Friday . . .	19	1 48 53.24	9.298	11 13 35.9	51.77	0 55.31	0.557
Saturday .	20	1 52 36.61	9.316	11 34 13.0	51.31	1 8.46	0.539
Sunday . .	21	1 56 20.42	9.335	11 54 38 8	50.84	1 21.17	0.520
Monday .	22	2 0 4.69	9.354	12 14 53.1	50.35	1 33 43	0.501
Tuesday .	23	2 3 49.42	9.374	12 34 55.4	49.85	1 45.22	0.481
Wednes'y	24	2 7 34.63	9.394	12 54 45.5	49.33	1 56.53	0.461
Thursday	25	2 11 20.34	9.415	13 14 23.0	48.79	2 7.35	0.440
Friday . . .	26	2 15 6.55	9.436	13 33 47.5	48.24	2 17.67	0.419
Saturday .	27	2 18 53.26	9.457	13 52 58.7	47.69	2 27.48	0.398
Sunday . .	28	2 22 40.50	9.479	14 11 56.4	47.11	2 36.77	0.376
Monday .	29	2 26 28.27	9.501	14 30 40.0	46.52	2 45.53	0.354
Tuesday .	30	2 30 16.57	9.524	14 49 9.4	45.92	2 53.76	0.332

TABLE XXI.

APRIL, 1878.—**Page 2.**

AT MEAN NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination.			Equation of Time, *to be subtracted from* / *added to Mean Time.*
		Apparent Right Ascension	*Apparent* Declination.	Semi-diameter.	
		h. m. s.	° ′ ″	′ ″	m. s.
Monday	1	0 42 46.63	N. 4 36 13.4	16 1.8	3 55.90
Tuesday	2	0 46 25.16	4 59 19.3	16 1.6	3 37.88
Wednesday .	3	0 50 3.83	5 22 19.9	16 1.3	3 19.99
Thursday ...	4	0 53 42.65	5 45 14.8	16 1.0	3 2.25
Friday.....	5	0 57 21.63	6 8 3.6	16 0.7	2 44.68
Saturday....	6	1 1 0.79	6 30 46.0	16 0.5	2 27.29
Sunday	7	1 4 40.14	6 53 21.7	16 0.2	2 10.09
Monday	8	1 8 19.71	7 15 50.3	15 59.9	1 53.10
Tuesday	9	1 11 59.50	7 38 11.3	15 59.7	1 36.34
Wednesday .	10	1 15 39.54	8 0 24.5	15 59.4	1 19.82
Thursday ...	11	1 19 19.83	8 22 29.5	15 59.1	1 3.56
Friday......	12	1 23 0.38	8 44 26.0	15 58.9	0 47.56
Saturday....	13	1 26 41.22	9 6 13.6	15 58.6	0 31.85
Sunday	14	1 30 22.37	9 27 52.1	15 58.3	0 16.44
Monday.....	15	1 34 3.84	9 49 21.1	15 58.1	0 1.36
Tuesday	16	1 37 45.66	10 10 40.4	15 57.8	0 13.38
Wednesday .	17	1 41 27.84	10 31 49.6	15 57.6	0 27.76
Thursday ...	18	1 45 10.41	10 52 48.4	15 57.3	0 41.74
Friday......	19	1 48 53.39	11 13 36.7	15 57.0	0 55.32
Saturday ...	20	1 52 36.79	11 34 14.0	15 56.8	1 8.47
Sunday	21	1 56 20.63	11 54 40.0	15 56.5	1 21.18
Monday	22	2 0 4.93	12 14 54.4	15 56.2	1 33.44
Tuesday	23	2 3 49.69	12 34 56.9	15 56.0	1 45.23
Wednesday .	24	2 7 34.94	12 54 47.1	15 55.7	1 56.54
Thursday ...	25	2 11 20.67	13 14 24.7	15 55.5	2 7.36
Friday......	26	2 15 6.91	13 33 49.3	15 55.2	2 17.68
Saturday....	27	2 18 53.65	13 53 0.7	15 55.0	2 27.49
Sunday	28	2 22 40.92	14 11 58.4	15 54.7	2 36.78
Monday	29	2 26 28.71	14 30 42.2	15 54.5	2 45.55
Tuesday	30	2 30 17.03	14 49 11.6	15 54.2	2 53.78

TABLE XXI.

MAY, 1878.—**Page 1.**

AT APPARENT NOON.

Day of the Week.	Day of the Month.	THE SUN'S RIGHT ASCENSION AND DECLINATION.				Equation of Time, *to be subtracted from Apparent Time.*	Var. in 1 hour.
		Apparent Right Ascension	Var. in 1 hour.	*Apparent* Declination.	Var. in 1 hour.		
		h. m. s.	s.	° ′ ″	″	m. s.	s.
Wednes'y	1	2 34 5.42	9.547	N.15 7 24.1	45.29	3 1.45	0.309
Thursday	2	2 37 54.81	9.570	15 25 23.9	44.67	3 8.59	0.286
Friday...	3	2 41 44.76	9.593	15 43 8.5	44.03	3 15.19	0.263
Saturday.	4	2 45 35.26	9.616	16 0 37.4	43.37	3 21.23	0.240
Sunday ..	5	2 49 26.31	9.639	16 17 50.3	42.70	3 26.72	0.217
Monday .	6	2 53 17.91	9.662	16 34 47.0	42.02	3 31.65	0.194
Tuesday .	7	2 57 10.07	9.685	16 51 27.1	41.32	3 36.04	0.171
Wednes'y	8	3 1 2.79	9.708	17 7 50.3	40.61	3 39.87	0.148
Thursday	9	3 4 56.06	9.731	17 23 56.4	39.89	3 43.15	0.125
Friday...	10	3 8 49.88	9.754	17 39 44.9	39.15	3 45.87	0.102
Saturday.	11	3 12 44.25	9.777	17 55 15.7	38.40	3 48.06	0.080
Sunday ..	12	3 16 39.17	9.800	18 10 28.3	37.64	3 49.69	0.056
Monday .	13	3 20 34.65	9.824	18 25 22.6	36.88	3 50.76	0.033
Tuesday .	14	3 24 30.70	9.847	18 39 58.4	36 10	3 51.27	0.010
Wednes'y	15	3 28 27.31	9.870	18 54 15.3	35.31	3 51.22	0.014
Thursday	16	3 32 24.48	9.894	19 8 13.1	34.51	3 50.60	0.038
Friday...	17	3 36 22 23	9.918	19 21 51.6	33.70	3 49.41	0.061
Saturday.	18	3 40 20.54	9.941	19 35 10.5	32.87	3 47.66	0.085
Sunday ..	19	3 44 19.42	9.965	19 48 9.5	32.04	3 45.35	0.108
Monday .	20	3 48 18.86	9.988	20 0 48.4	31.20	3 42.47	0.131
Tuesday .	21	3 52 18.86	10.012	20 13 7.0	30.34	3 39.04	0.155
Wednes'y	22	3 56 19.42	10.035	20 25 4.9	29.48	3 35.05	0.178
Thursday	23	4 0 20.52	10.057	20 36 42.0	28.60	3 30.52	0.200
Friday...	24	4 4 22.15	10.079	20 47 57.9	27.72	3 25.46	0.222
Saturday.	25	4 8 24.31	10.101	20 58 52.4	26.82	3 19.87	0.244
Sunday ..	26	4 12 26.98	10.122	21 9 25.3	25.91	3 13.76	0.265
Monday .	27	4 16 30.17	10.143	21 19 36.3	25.00	3 7.15	0.286
Tuesday .	28	4 20 33.86	10.163	21 29 25.3	24.08	3 0.05	0.306
Wednes'y	29	4 24 38.01	10.182	21 38 51.9	23.14	2 52.48	0.325
Thursday	30	4 28 42.62	10.201	21 47 56.1	22.20	2 44.45	0.344
Friday...	31	4 32 47.68	10.220	21 56 37.5	21.25	2 35.97	0 362

TABLE XXI.

MAY, 1878.—Page 2.

AT MEAN NOON.

Day of the Week.	Day of the Month.	THE SUN'S RIGHT ASCENSION AND DECLINATION.			Equation of Time, *to be added to Mean Time.*
		Apparent Right Ascension	*Apparent* Declination.	Semi-diameter.	
		h. m. s.	° ′ ″	′ ″	m. s.
Wednesday .	1	2 34 5.90	N.15 7 26.4	15 54.0	3 1.46
Thursday ...	2	2 37 55.31	15 25 26.3	15 53.7	3 8.61
Friday......	3	2 41 45.28	15 43 10.9	15 53.5	3 15.20
Saturday....	4	2 45 35.79	16 0 39.8	15 53.3	3 21.24
Sunday	5	2 49 26.86	16 17 52.8	15 53.1	3 26.73
Monday	6	2 53 18.48	16 34 49.5	15 52.8	3 31.67
Tuesday	7	2 57 10.65	16 51 29.6	15 52.6	3 36.05
Wednesday .	8	3 1 3.38	17 7 52.8	15 52.4	3 39.88
Thursday ...	9	3 4 56.66	17 23 58.9	15 52.2	3 43.16
Friday......	10	3 8 50.49	17 39 47.4	15 52.0	3 45.88
Saturday....	11	3 12 44.86	17 55 18.1	15 51.8	3 48.06
Sunday	12	3 16 39.79	18 10 30.7	15 51.6	3 49.69
Monday	13	3 20 35.28	18 25 25.0	15 51.4	3 50.76
Tuesday .	14	3 24 31.33	18 40 0.7	15 51.2	3 51.27
Wednesday .	15	3 28 27.94	18 54 17.5	15 51.0	3 51.21
Thursday ...	16	3 32 25.11	19 8 15.3	15 50.8	3 50 60
Friday......	17	3 36 22.86	19 21 53.7	15 50.6	3 49.41
Saturday....	18	3 40 21.17	19 35 12.5	15 50.4	3 47.66
Sunday	19	3 44 20.04	19 48 11.5	15 50.2	3 45.34
Monday	20	3 48 19.48	20 0 50.4	15 50.0	3 42.46
Tuesday	21	3 52 19.47	20 13 8.9	15 49.9	3 39.03
Wednesday .	22	3 56 20.02	20 25 6.7	15 49.7	3 35.04
Thursday ...	23	4 0 21.11	20 36 43.7	15 49.5	3 30 51
Friday......	24	4 4 22.73	20 47 59.5	15 49.3	3 25.44
Saturday....	25	4 8 24.87	20 58 53.9	15 49.2	3 19.85
Sunday	26	4 12 27.53	21 9 26.7	15 49.0	3 13.75
Monday	27	4 16 30.70	21 19 37.6	15 48.8	3 7.14
Tuesday	28	4 20 34.36	21 29 26.5	15 48.7	3 0.04
Wednesday .	29	4 24 38.49	21 38 53.0	15 48.5	2 52.47
Thursday ...	30	4 28 43.09	21 47 57.1	15 48.4	2 44.43
Friday....	31	4 32 48.12	21 56 38.5	15 48.2	2 35.96

TABLE XXI.

JUNE, 1878.—Page 1.

AT APPARENT NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination. *Apparent* Right Ascension	Var. in 1 hour.	*Apparent* Declination.	Var. in 1 hour.	Equation of Time *to be subt. from* *added to* *Apparent Time.*	Var. in 1 hour.
		h. m. s.	s.	° ′ ″	″	m. s.	s.
Saturday .	1	4 36 53.16	10.237	N.22 4 56.1	20.29	2 27.07	0.379
Sunday . .	2	4 40 59.04	10.253	22 12 51.5	19.32	2 17.78	0.395
Monday .	3	4 45 5.30	10.268	22 20 23.7	18.35	2 8.10	0.411
Tuesday .	4	4 49 11.92	10.283	22 27 32.4	17.37	1 58.07	0.425
Wednes'y	5	4 53 18.87	10.296	22 34 17.6	16.39	1 47.70	0.438
Thursday	6	4 57 26.13	10.308	22 40 39.1	15.40	1 37.03	0.451
Friday. . .	7	5 1 33.67	10.320	22 46 36.6	14.40	1 26.07	0.462
Saturday .	8	5 5 41.48	10.331	22 52 10.1	13.40	1 14.85	0.473
Sunday . .	9	5 9 49.54	10.341	22 57 19.6	12.39	1 3.38	0.483
Monday .	10	5 13 57.83	10.350	23 2 4.8	11.38	0 51.68	0.492
Tuesday .	11	5 18 6.33	10.358	23 6 25.7	10.36	0 39.77	0.509
Wednes'y	12	5 22 15.03	10.366	23 10 22.3	9.35	0 27.67	0.508
Thursday	13	5 26 23.90	10.373	23 13 54.5	8.33	0 15.39	0.515
Friday. . .	14	5 30 32.92	10.379	23 17 2.1	7.30	0 2.96	0.521
Saturday .	15	5 34 42.09	10.385	23 19 45.1	6.28	0 9.62	0.526
Sunday . .	16	5 38 51.38	10.389	23 22 3 5	5.25	0 22 31	0 531
Monday .	17	5 43 0.76	10.393	23 23 57.3	4.23	0 35.10	0.535
Tuesday .	18	5 47 10.23	10.396	23 25 26.4	3.19	0 47.97	0.537
Wednes'y	19	5 51 19.75	10.398	23 26 30.6	2.16	1 0.90	0.539.
Thursday	20	5 55 29.31	10.399	23 27 10.1	1.13	1 13.86	0.540
Friday. . .	21	5 59 38.88	10.399	23 27 24 7	0.09	1 26.84	0.541
Saturday .	22	6 3 48.45	10.398	23 27 14.5	0.94	1 39.81	0.540
Sunday . .	23	6 7 57.98	10.397	23 26 39.5	1.98	1 52.76	0.538
Monday .	24	6 12 7.47	10.394	23 25 39.6	3.01	2 5.65	0.535
Tuesday .	25	6 16 16.88	10.390	23 24 15.0	4.04	2 18.46	0.532
Wednes'y	26	6 20 26.18	10.385	23 22 25.6	5.07	2 31.17	0.527
Thursday	27	6 24 35.36	10.379	23 20 11.5	6.10	2 43.76	0.521
Friday. . .	28	6 28 44.39	10.373	23 17 32.7	7.13	2 56.20	0.515
Saturday .	29	6 32 53.25	10.365	23 14 29.4	8.15	3 8.46	0.507
Sunday . .	30	6 37 1.90	10.356	23 11 1.6	9.17	3 20.52	0.498

TABLE XXI.

JUNE, 1878.—Page 2.

AT MEAN NOON.

Day of the Week.	Day of the Month.	THE SUN'S RIGHT ASCENSION AND DECLINATION.			Equation of Time, *to be added to* / *subtracted from* *Mean Time.*
		Apparent Right Ascension	*Apparent* Declination.	Semi-diameter.	
		h. m. s.	° ′ ″	′ ″	m. s.
Saturday....	1	4 36 53.57	N. 22 4 56.9	15 48.1	2 27.06
Sunday	2	4 40 59.43	22 12 52.3	15 48.0	2 17.76
Monday.....	3	4 45 5.67	22 20 24.4	15 47.9	2 8.08
Tuesday	4	4 49 12.26	22 27 33.0	15 47.7	1 58.05
Wednesday .	5	4 53 19.18	22 34 18.1	15 47.6	1 47.69
Thursday ...	6	4 57 26.40	22 40 39.5	15 47.5	1 37.02
Friday......	7	5 1 33.92	22 46 37.0	15 47.4	1 26.06
Saturday ...	8	5 5 41.70	22 52 10.4	15 47.3	1 14.84
Sunday	9	5 9 49.73	22 57 19.8	15 47.2	1 3.37
Monday	10	5 13 57.98	23 2 5.0	15 47.1	0 51.68
Tuesday	11	5 18 6.45	23 6 25.9	15 47.0	0 39.77
Wednesday .	12	5 22 15.11	23 10 22.4	15 46.9	0 27.67
Thursday ...	13	5 26 23.94	23 13 54.5	15 46.8	0 15.39
Friday.....	14	5 30 32.93	23 17 2.1	15 46.7	0 2.96
Saturday....	15	5 34 42.06	23 19 45.1	15 46.6	0 9.62
Sunday	16	5 38 51.31	23 22 3.5	15 46.6	0 22.31
Monday	17	5 43 0.66	23 23 57.3	15 46.5	0 35.10
Tuesday	18	5 47 10.09	23 25 26.3	15 46.5	0 47.96
Wednesday .	19	5 51 19.57	23 26 30.6	15 46.4	1 0.89
Thursday ...	20	5 55 29.09	23 27 10.1	15 46.3	1 13.85
Friday......	21	5 59 38.63	23 27 24.7	15 46.3	1 26.83
Saturday....	22	6 3 48.16	23 27 14.5	15 46.2	1 39.80
Sunday	23	6 7 57.66	23 26 39.5	15 46.2	1 52.74
Monday	24	6 12 7.11	23 25 39.7	15 46.1	2 5.63
Tuesday	25	6 16 16.48	23 24 15.1	15 46.1	2 18.44
Wednesday .	26	6 20 25.75	23 22 25.8	15 46.1	2 31.15
Thursday ...	27	6 24 34.89	23 20 11.8	15 46.0	2 43.74
Friday......	28	6 28 43.89	23 17 33.1	15 46.0	2 56.18
Saturday....	29	6 32 52.71	23 14 29.8	15 46.0	3 8.44
Sunday	30	6 37 1.32	23 11 2.1	15 46.0	3 20.50

TABLE XXI.

JULY, 1878.—Page 1.

AT APPARENT NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination.				Equation of Time, *to be added to Apparent Time.*	Var. in 1 hour.
		Apparent Right Ascension	Var. in 1 hour.	*Apparent* Declination.	Var. in 1 hour.		
		h. m. s.	s.	° ′ ″	″	m. s.	s.
Monday .	1	6 41 10.32	10.345	N.23 7 9.4	10.18	3 32.35	0.487
Tuesday .	2	6 45 18.47	10.334	23 2 53.0	11.19	3 43.91	0.476
Wednes'y	3	6 49 26.33	10.321	22 58 12.4	12.19	3 55.18	0.463
Thursday	4	6 53 33.88	10.307	22 53 7.7	13.19	4 6.14	0.450
Friday . . .	5	6 57 41.09	10.293	22 47 39.2	14.18	4 16.77	0.435
Saturday .	6	7 1 47.94	10.278	22 41 46.9	15.17	4 27.03	0.420
Sunday . .	7	7 5 54.41	10.261	22 35 31.0	16.15	4 36.91	0.404
Monday .	8	7 10 0.48	10.244	22 28 51.7	17.12	4 46.40	0.387
Tuesday	9	7 14 6.14	10.227	22 21 49.3	18.09	4 55.48	0.369
Wednes'y	10	7 18 11.37	10.209	22 14 23.5	19.05	5 4.13	0.351
Thursday	11	7 22 16.16	10.190	22 6 35.0	20.00	5 12.34	0.333
Friday . . .	12	7 26 20.50	10.171	21 58 23.7	20.94	5 20.10	0.314
Saturday .	13	7 30 24.37	10.151	21 49 49.9	21.87	5 27.39	0.294
Sunday . .	14	7 34 27.77	10.131	21 40 53.7	22.80	5 34.21	0.274
Monday .	15	7 38 30.67	10.110	21 31 35.3	23.72	5 40.54	0.253
Tuesday .	16	7 42 33.07	10.089	21 21 55.0	24.64	5 46.37	0.232
Wednes'y	17	7 46 34.96	10.068	21 11 52.8	25.54	5 51.69	0.211
Thursday	18	7 50 36.34	10.047	21 1 29.1	26.43	5 56.49	0.189
Friday . . .	19	7 54 37.20	10.025	20 50 44.0	27.32	6 0.78	0.167
Saturday .	20	7 58 37.52	10.002	20 39 37.7	28.20	6 4.53	0.145
Sunday . . .	21	8 2 37.30	9.979	20 28 10.6	29.06	6 7.74	0.122
Monday .	22	8 6 36.53	9.957	20 16 22.7	29.92	6 10.41	0.100
Tuesday .	23	8 10 35.21	9.933	20 4 14.3	30.77	6 12.53	0.077
Wednes'y	24	8 14 33.33	9.910	19 51 45.7	31.61	6 14.09	0.053
Thursday	25	8 18 30.89	9.886	19 38 57.2	32.43	6 15.09	0.030
Friday . . .	26	8 22 27.87	9.862	19 25 49.0	33.25	6 15.51	0.006
Saturday .	27	8 26 24.27	9.838	19 12 21.4	34.05	6 15.36	0.019
Sunday . .	28	8 30 20.08	9.813	18 58 34.6	34.84	6 14.61	0.044
Monday .	29	8 34 15.30	9.788	18 44 29.1	35.61	6 13.27	0.068
Tuesday .	30	8 38 9.91	9.762	18 30 5.1	36.38	6 11.33	0.094
Wednes'y	31	8 42 3.90	9.737	18 15 22.8	37.14	6 8.77	0.119

TABLE XXI.

JULY, 1878.—Page 2.

AT MEAN NOON.

Day of the Week.	Day of the Month.	THE SUN'S RIGHT ASCENSION AND DECLINATION.			Equation of Time, *to be subtracted from Mean Time.*
		Apparent Right Ascension	*Apparent* Declination.	Semi-diameter.	
		h. m. s.	° ′ ″	′ ″	m. s.
Monday	1	6 41 9.71	N.23 7 10.0	15 46.0	3 32.32
Tuesday	2	6 45 17.83	23 2 53.7	15 46.0	3 43.88
Wednesday .	3	6 49 25.66	22 58 13.2	15 46.0	3 55.15
Thursday ...	4	6 53 33.17	22 53 8.6	15 46.0	4 6.11
Friday......	5	6 57 40.35	22 47 40.2	15 46.0	4 16.73
Saturday....	6	7 1 47.17	22 41 48.1	15 46.0	4 27.00
Sunday	7	7 5 53.61	22 35 32.3	15 46.0	4 36.88
Monday	8	7 9 59.66	22 28 53.1	15 46.1	4 46.37
Tuesday	9	7 14 5.30	22 21 50.7	15 46.1	4 55.45
Wednesday .	10	7 18 10.51	22 14 25.1	15 46.1	5 4.10
Thursday ...	11	7 22 15.28	22 6 36.7	15 46.2	5 12 31
Friday......	12	7 26 19.60	21 58 25.5	15 46.2	5 20.07
Saturday....	13	7 30 23.45	21 49 51.8	15 46.3	5 27.37
Sunday	14	7 34 26.82	21 40 55.8	15 46.3	5 34.18
Monday	15	7 38 29.71	21 31 37.6	15 46.4	5 40.51
Tuesday	16	7 42 32.10	21 21 57.4	15 46.4	5 46 34
Wednesday .	17	7 46 33.98	21 11 55.3	15 46.5	5 51.66
Thursday ...	18	7 50 35.35	21 1 31.7	15 46.5	5 56.47
Friday......	19	7 54 36.19	20 50 46.7	15 46.6	6 0.76
Saturday....	20	7 58 36.50	20 39 40.6	15 46.7	6 4.51
Sunday	21	8 2 36.28	20 28 13.5	15 46.7	6 7.73
Monday	22	8 6 35.51	20 16 25.7	15 46.8	6 10.40
Tuesday	23	8 10 34.18	20 4 17.5	15 46.9	6 12.52
Wednesday	24	8 14 32.30	19 51 49.0	15 47.0	6 14.08
Thursday ...	25	8 18 29.86	19 39 0.6	15 47.1	6 15.08
Friday......	26	8 22 26.84	19 25 52.5	15 47.2	6 15.51
Saturday....	27	8 26 23.25	19 12 24.9	15 47.3	6 15.36
Sunday	28	8 30 19.06	18 58 38.3	15 47.4	6 14.62
Monday	29	8 34 14.28	18 44 32.8	15 47.5	6 13.28
Tuesday	30	8 38 8.90	18 30 8 8	15 47.6	6 11.34
Wednesday .	31	8 42 2.90	18 15 26.6	15 47.7	6 8.78

TABLE XXI.

AUGUST, 1878.—Page 1.

AT APPARENT NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination.								Equation of Time to be added to subt. from Apparent Time.		Var. in 1 hour.
		Apparent Right Ascension			Var. in 1 hour.	*Apparent* Declination.			Var. in 1 hour.			
		h.	m.	s.	s.	°	′	″	″	m.	s.	s.
Thursday	1	8	45	57.27	9.711	N.18	0	22.6	37.88	6	5.60	0.145
Friday...	2	8	49	50.02	9.685	17	45	4.8	38.60	6	1.80	0.171
Saturday.	3	8	53	42.15	9.659	17	29	29.8	39.31	5	57.39	0.197
Sunday ..	4	8	57	33.66	9.633	17	13	37.8	40.01	5	52.36	0.223
Monday .	5	9	1	24.55	9.608	16	57	29.1	40.70	5	46.70	0.248
Tuesday .	6	9	5	14.83	9.582	16	41	4.1	41.38	5	40.44	0.274
Wednes'y	7	9	9	4.49	9.557	16	24	23.0	42.04	5	33.57	0.299
Thursday	8	9	12	53.55	9.532	16	7	26.1	42.69	5	26.09	0.324
Friday...	9	9	16	42.01	9.507	15	50	13.8	43.33	5	18.02	0.349
Saturday.	10	9	20	29.88	9.482	15	32	46.4	43.95	5	9.35	0.373
Sunday ..	11	9	24	17.16	9.458	15	15	4.0	44.57	5	0.11	0.397
Monday .	12	9	28	3.88	9.435	14	57	7.1	45.17	4	50.29	0.421
Tuesday .	13	9	31	50.03	9.411	14	38	55.8	45.76	4	39.92	0.444
Wednes'y	14	9	35	35.63	9.389	14	20	30.6	46.34	4	29.00	0.466
Thursday	15	9	39	20.70	9.367	14	1	51.6	46.90	4	17.54	0.488
Friday...	16	9	43	5.25	9.345	13	42	59 2	47.46	4	5 56	0 510
Saturday.	17	9	46	49.28	9.324	13	23	53.6	48.00	3	53.08	0.530
Sunday ..	18	9	50	32.82	9.304	13	4	35.2	48.53	3	40.10	0.551
Monday .	19	9	54	15.88	9.284	12	45	4.1	49.05	3	26.64	0.571
Tuesday .	20	9	57	58.47	9.265	12	25	20.8	49.55	3	12.71	0.590
Wednes'y	21	10	1	40.60	9.246	12	5	25.7	50.04	2	58.33	0.609
Thursday	22	10	5	22.29	9.228	11	45	18.9	50.52	2	43 50	0.627
Friday...	23	10	9	3.55	9.210	11	25	0.8	50.98	2	28.25	0.644
Saturday.	24	10	12	44.39	9.193	11	4	31.7	51.43	2	12.58	0.661
Sunday ..	25	10	16	24.82	9.176	10	43	52.0	51.87	1	56.50	0.678
Monday .	26	10	20	4.86	9.160	10	23	2.0	52.29	1	40.02	0.695
Tuesday .	27	10	23	44.51	9.144	10	2	2.1	52.70	1	23.16	0.710
Wednes'y	28	10	27	23.78	9.129	9	40	52.6	53.09	1	5.93	0.726
Thursday	29	10	31	2.69	9.114	9	19	33.8	53.47	0	48.33	0.741
Friday...	30	10	34	41.24	9.099	8	58	6.1	53.83	0	30.38	0.755
Saturday.	31	10	38	19.46	9.086	8	36	30.0	54.18	0	12.09	0.769

TABLE XXI.

AUGUST, 1878.—**Page 2.**

AT MEAN NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination. *Apparent* Right Ascension	*Apparent* Declination.	Semi-diameter.	Equation of Time, *to be subtracted from* / *added to* *Mean Time.*
		h. m. s.	° ′ ″	′ ″	m. s.
Thursday . . .	1	8 45 56.29	N.18 0 26.5	15 47.9	6 5.61
Friday.	2	8 49 49.05	17 45 8.7	15 48.0	6 1.82
Saturday. . . .	3	8 53 41.20	17 29 33.7	15 48.1	5 57.41
Sunday	4	8 57 32.72	17 13 41.7	15 48.3	5 52.38
Monday	5	9 1 23.63	16 57 33.0	15 48.4	5 46.73
Tuesday	6	9 5 13.92	16 41 8.0	15 48.6	5 40.47
Wednesday .	7	9 9 3.61	16 24 26.9	15 48.7	5 33.60
Thursday . . .	8	9 12 52.69	16 7 30.0	15 48.9	5 26.12
Friday.	9	9 16 41.17	15 50 17.7	15 49.0	5 18.04
Saturday. . . .	10	9 20 29.06	15 32 50.1	15 49.2	5 9.38
Sunday	11	9 24 16.37	15 15 7.7	15 49.4	5 0.14
Monday	12	9 28 3.12	14 57 10.7	15 49.5	4 50.33
Tuesday	13	9 31 49.30	14 38 59.4	15 49.7	4 39.95
Wednesday .	14	9 35 34.93	14 20 34.0	15 49.9	4 29.03
Thursday . . .	15	9 39 20.03	14 1 54.9	15 50.1	4 17.58
Friday.	16	9 43 4.61	13 43 2.4	15 50.2	4 5.60
Saturday. . . .	17	9 46 48.68	13 23 56.7	15 50.4	3 53.11
Sunday	18	9 50 32.25	13 4 38.1	15 50.6	3 40.13
Monday	19	9 54 15.35	12 45 7.0	15 50.8	3 26.67
Tuesday	20	9 57 57.97	12 25 23.5	15 51.0	3 12.74
Wednesday.	21	10 1 40.14	12 5 28.2	15 51.2	2 58.36
Thursday . . .	22	10 5 21.87	11 45 21.2	15 51.4	2 43.53
Friday.	23	10 9 3.17	11 25 2.9	15 51.6	2 28.27
Saturday. . . .	24	10 12 44.05	11 4 33.6	15 51.8	2 12.60
Sunday	25	10 16 24.52	10 43 53.7	15 52.0	1 56.52
Monday.	26	10 20 4.60	10 23 3.5	15 52.2	1 40.04
Tuesday	27	10 23 44.29	10 2 3.3	15 52.4	1 23.18
Wednesday .	28	10 27 23.61	9 40 53.5	15 52.6	1 5.94
Thursday . . .	29	10 31 2.57	9 19 34.5	15 52.8	0 48.34
Friday.	30	10 34 41.17	8 58 6.6	15 53.1	0 30.39
Saturday . .	31	10 38 19.43	8 36 30.1	15 53.3	0 12.10

TABLE XXI.

SEPTEMBER, 1878.—**Page 1.**

AT APPARENT NOON.

Day of the Week.	Day of the Month.	THE SUN'S RIGHT ASCENSION AND DECLINATION.				Equation of Time, *to be subtracted from Apparent Time.*	Var. in 1 hour.
		Apparent Right Ascension	Var. in 1 hour.	*Apparent* Declination.	Var. in 1 hour.		
		h. m. s.	s.	° ′ ″	″	m. s.	s.
Sunday . .	1	10 41 57.35	9.072	N. 8 14 45.6	54.51	0 6.52	0.782
Monday .	2	10 45 34.93	9.060	7 52 53.4	54.83	0 25.44	0.794
Tuesday	3	10 49 12.22	9.048	7 30 53.6	55.14	0 44.65	0.806
Wednes'y	4	10 52 49.23	9.037	7 8 46.7	55.43	1 4.14	0.817
Thursday	5	10 56 25.98	9.026	6 46 32.9	55.71	1 23.89	0.828
Friday . . .	6	11 0 2.49	9.017	6 24 12.6	55.97	1 43.88	0.838
Saturday .	7	11 3 38.78	9.008	6 1 46.1	56.23	2 4.10	0.846
Sunday . .	8	11 7 14.86	9.000	5 39 13.7	56.47	2 24.51	0.854
Monday .	9	11 10 50.76	8.993	5 16 35.6	56.70	2 45.11	0.861
Tuesday .	10	11 14 26.50	8.986	4 53 52.2	56.91	3 5.86	0.868
Wednes'y	11	11 18 2.10	8.981	4 31 3.8	57.11	3 26.76	0.873
Thursday	12	11 21 37.59	8.977	4 8 10.7	57.30	3 47.76	0.877
Friday . . .	13	11 25 12.99	8.974	3 45 13.2	57.48	4 8.86	0.881
Saturday .	14	11 28 48 32	8.971	3 22 11.5	57 65	4 30.03	0.883
Sunday . .	15	11 32 23.61	8.970	2 59 6.1	57.80	4 51.24	0.884
Monday .	16	11 35 58.87	8.969	2 35 57.2	57.94	5 12.47	0.885
Tuesday .	17	11 39 34.13	8.970	2 12 45.1	58 06	5 33.70	0.884
Wednes'y	18	11 43 9.41	8.971	1 49 30.2	58.17	5 54.91	0.883
Thursday	19	11 46 44.74	8.973	1 26 12.8	58.27	6 16.08	0.881
Friday . . .	20	11 50 20.13	8.976	1 2 53.2	58.36	6 37.19	0.878
Saturday .	21	11 53 55.61	8.980	0 39 31.7	58.43	6 58 21	0.874
Sunday . .	22	11 57 31.19	8.985	0 16 8.8	58.48	7 19.12	0.869
Monday .	23	12 1 6.89	8.990	0 7 15.3	58.52	7 39.92	0.864
Tuesday .	24	12 4 42.73	8.997	0 30 40.1	58.54	8 0.58	0.858
Wednes'y	25	12 8 18.73	9.003	0 54 5.3	58.55	8 21.08	0.851
Thursday	26	12 11 54.89	9.011	1 17 30.5	58.54	8 41.41	0.843
Friday . . .	27	12 15 31.25	9.019	1 40 55.3	58.52	9 1.55	0.835
Saturday .	28	12 19 7.82	9.028	2 4 19.4	58.48	9 21.48	0.826
Sunday . .	29	12 22 44.61	9.038	2 27 42.4	58.43	9 41.18	0.816
Monday .	30	12 26 21.65	9.049	2 51 3.9	58.36	10 0.64	0.806

TABLE XXI.

SEPTEMBER, 1878.—Page 2.

AT MEAN NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination.			Equation of Time, *to be added to Mean Time.*
		Apparent Right Ascension	*Apparent* Declination.	Semi-diameter.	
		h. m. s.	° ′ ″	′ ″	m. s.
Sunday	1	10 41 57.37	N. 8 14 45.5	15 53.5	0 6.52
Monday	2	10 45 35.00	7 52 53.0	15 53.8	0 25.44
Tuesday	3	10 49 12.33	7 30 52.9	15 54.0	0 34.66
Wednesday .	4	10 52 49.39	7 8 45.7	15 54.2	1 4.16
Thursday ...	5	10 56 26.19	6 46 31.6	15 54.5	1 23.91
Friday......	6	11 0 2.75	6 24 11.0	15 54.7	1 43.91
Saturday....	7	11 3 39.09	6 1 44.2	15 55.0	2 4.13
Sunday	8	11 7 15.22	5 39 11.4	15 55.2	2 24.55
Monday	9	11 10 51.17	5 16 33.0	15 55.5	2 45.15
Tuesday	10	11 14 26.97	4 53 49.2	15 55.7	3 5.91
Wednesday .	11	11 18 2.62	4 31 0.5	15 56.0	3 26 81
Thursday ...	12	11 21 38.16	4 8 7.0	15 56.3	3 47.82
Friday......	13	11 25 13.61	3 45 9.2	15 56.5	4 8.92
Saturday....	14	11 28 48.99	3 22 7.2	15 56.8	4 30.09
Sunday	15	11 32 24.33	2 59 1.4	15 57.0	4 51.31
Monday	16	11 35 59.64	2 35 52.2	15 57.3	5 12 55
Tuesday	17	11 39 34.96	2 12 39.8	15 57.5	5 33.79
Wednesday	18	11 43 10.30	1 49 24.5	15 57.8	5 55.00
Thursday ...	19	11 46 45.68	1 26 6.7	15 58.0	6 16.18
Friday......	20	11 50 21.12	1 2 46.7	15 58.3	6 37.29
Saturday....	21	11 53 56.65	0 39 24.9	15 58.6	6 58.31
Sunday	22	11 57 32.29	N. 0 16 1.6	15 58.8	7 19.23
Monday	23	12 1 8.04	S. 0 7 22.8	15 59.1	7 40.03
Tuesday	24	12 4 43.93	0 30 47.9	15 59.4	8 0.69
Wednesday .	25	12 8 19.98	0 54 13.5	15 59.6	8 21.19
Thursday ...	26	12 11 56.20	1 17 39.0	15 59.9	8 41.53
Friday......	27	12 15 32.61	1 41 4.2	16 0.2	9 1.68
Saturday....	28	12 19 9.23	2 4 28.6	16 0.5	9 21.61
Sunday	29	12 22 46.07	2 27 51.8	16 0.7	9 41.31
Monday	30	12 26 23.16	2 51 13.6	16 1.0	10 0.77

TABLE XXI.

OCTOBER, 1878.—**Page 1.**

AT APPARENT NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination.				Equation of Time *to be subtracted from Apparent Time.*	Var. in 1 hour.
		Apparent Right Ascension	Var. in 1 hour.	*Apparent* Declination.	Var. in 1 hour.		
		h. m. s.	s.	° ′ ″	″	m. s.	s.
Tuesday .	1	12 29 58.95	9.060	S. 3 14 23.5	58.27	10 19.85	0.795
Wednes'y	2	12 33 36.52	9.072	3 37 40.8	58.17	10 38.78	0.783
Thursday	3	12 37 14.39	9.084	4 0 55.6	58.06	10 57.41	0.770
Friday. . .	4	12 40 52.57	9.098	4 24 7.5	57.93	11 15.73	0.756
Saturday.	5	12 44 31.09	9.112	4 47 16.0	57.78	11 33.72	0.742
Sunday . .	6	12 48 9.96	9.127	5 10 20.9	57.62	11 51.35	0.727
Monday .	7	12 51 49.21	9.144	5 33 21.8	57.45	12 8.61	0.711
Tuesday .	8	12 55 28.86	9.161	5 56 18.4	57.26	12 25.47	0.694
Wednes'y	9	12 59 8.93	9.179	6 19 10.3	57.06	12 41.91	0.676
Thursday	10	13 2 49.45	9.198	6 41 57.2	56.84	12 57.90	0.657
Friday. . .	11	13 6 30.43	9.218	7 4 38.7	56.61	13 13.43	0.637
Saturday .	12	13 10 11.91	9.239	7 27 14.5	56.36	13 28.46	0.616
Sunday . .	13	13 13 53.90	9.261	7 49 44.2	56.10	13 42.99	0.594
Monday .	14	13 17 36.43	9.284	8 12 7.5	55.83	13 56.98	0.571
Tuesday .	15	13 21 19.51	9.307	8 34 24.0	55.54	14 10.41	0.548
Wednes'y	16	13 25 3.16	9.331	8 56 33 4	55.23	14 23.27	0 524
Thursday	17	13 28 47.42	9.357	9 18 35.2	54.91	14 35.54	0.498
Friday. . .	18	13 32 32.29	9.383	9 40 29.2	54.57	14 47.19	0.472
Saturday .	19	13 36 17.79	9.409	10 2 14.8	54.22	14 58.22	0.446
Sunday . .	20	13 40 3.94	9.437	10 23 51.8	53.85	15 8.60	0.419
Monday .	21	13 43 50.75	9.465	10 45 19.6	53.46	15 18.31	0.390
Tuesday .	22	13 47 38.24	9.493	11 6 37.9	53.06	15 27 34	0.362
Wednes'y	23	13 51 26.43	9.523	11 27 46.3	52.63	15 35.69	0.333
Thursday	24	13 55 15.33	9.552	11 48 44.3	52.19	15 43.33	0.303
Friday. . .	25	13 59 4.94	9.582	12 9 31.5	51.73	15 50.24	0.274
Saturday .	26	14 2 55.29	9.613	12 30 7.5	51.26	15 56.44	0.243
Sunday . .	27	14 6 46.37	9.644	12 50 31.9	50.76	16 1.90	0.212
Monday .	28	14 10 38.20	9.675	13 10 44.2	50.25	16 6.61	0.181
Tuesday .	29	14 14 30.78	9.706	13 30 44.0	49.72	16 10.58	0.149
Wednes'y	30	14 18 24.11	9.738	13 50 30.9	49.18	16 13.78	0.118
Thursday	31	14 22 18.21	9.770	14 10 4.6	48.62	16 16.23	0.086

TABLE XXI.

OCTOBER, 1878.—**Page 2.**

AT MEAN NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination.			Equation of Time, *to be added to Mean Time.*
		Apparent Right Ascension	*Apparent* Declination.	Semi-diameter.	
		h. m. s.	° ′ ″	′ ″	m. s.
Tuesday	1	12 30 0.51	S. 3 14 33.5	16 1.3	10 19.98
Wednesday .	2	12 33 38.13	3 37 51.2	16 1.6	10 38.92
Thursday ...	3	12 37 16.05	4 1 6.2	16 1.9	10 57.55
Friday......	4	12 40 54.28	4 24 18.3	16 2.1	11 15.87
Saturday....	5	12 44 32.85	4 47 27.1	16 2.4	11 33.86
Sunday	6	12 48 11.77	5 10 32.3	16 2.7	11 51.50
Monday	7	12 51 51.06	5 33 33 4	16 3.0	12 8.76
Tuesday	8	12 55 30.76	5 56 30.2	16 3.3	12 25.61
Wednesday.	9	12 59 10.87	6 19 22.4	16 3.6	12 42.05
Thursday ...	10	13 2 51.44	6 42 9.5	16 3.8	12 58.04
Friday....	11	13 6 32.47	7 4 51.2	16 4.1	13 13.57
Saturday....	12	13 10 13.99	7 27 27.1	16 4.4	13 28.60
Sunday	13	13 13 56.02	7 49 57.0	16 4.7	13 43.12
Monday.....	14	13 17 38.58	8 12 20.5	16 4.9	13 57.11
Tuesday	15	13 21 21.70	8 34 37.1	16 5.2	14 10.54
Wednesday .	16	13 25 5.40	8 56 46.6	16 5.5	14 23.40
Thursday ...	17	13 28 49.69	9 18 48.6	16 5.7	14 35 66
Friday......	18	13 32 34.60	9 40 42.6	16 6.0	14 47.31
Saturday....	19	13 36 20.13	10 2 28.3	16 6.3	14 58 33
Sunday	20	13 40 6.32	10 24 5.3	16 6.5	15 8.70
Monday	21	13 43 53.17	10 45 33.2	16 6.8	15 18.41
Tuesday	22	13 47 40.69	11 6 51.6	16 7.0	15 27.44
Wednesday .	23	13 51 28.91	11 28 0.0	16 7.3	15 35.77
Thursday ...	24	13 55 17.83	11 48 57.9	16 7.6	15 43.40
Friday.....	25	13 59 7.47	12 9 45.1	16 7.8	15 50.31
Saturday....	26	14 2 57.84	12 30 21.1	16 8.1	15 56.50
Sunday	27	14 6 48.95	12 50 45.4	16 8.4	16 1.95
Monday	28	14 10 40.80	13 10 57.6	16 8.6	16 6.66
Tuesday	29	14 14 33.40	13 30 57.4	16 8.9	16 10.62
Wednesday .	30	14 18 26.75	13 50 44.2	16 9.1	16 13 82
Thursday ...	31	14 22 20.86	14 10 17.7	16 9.4	16 16.26

TABLE XXI.

NOVEMBER, 1878.—**Page 1.**

AT APPARENT NOON.

Day of the Week.	Day of the Month.	THE SUN'S RIGHT ASCENSION AND DECLINATION.				Equation of Time, *to be subtracted from Apparent Time.*	Var. in 1 hour.
		Apparent Right Ascension	Var. in 1 hour.	*Apparent* Declination.	Var. in 1 hour.		
		h. m. s.	s.	° ′ ″	″	m. s.	s.
Friday . . .	1	14 26 13.09	9.803	S. 14 29 24.5	48.04	16 17.91	0.054
Saturday .	2	14 30 8.74	9.835	14 48 30.3	47.44	16 18.81	0.021
Sunday . .	3	14 34 5.19	9.869	15 7 21.5	46.83	16 18.92	0.012
Monday .	4	14 38 2.43	9.902	15 25 57.9	46.20	16 18.23	0.045
Tuesday .	5	14 42 0.49	9.936	15 44 18.9	45.55	16 16.74	0.079
Wednes'y	6	14 45 59.36	9.970	16 2 24.2	44.89	16 14.43	0.114
Thursday	7	14 49 59.06	10.005	16 20 13.4	44.21	16 11.29	0.148
Friday . . .	8	14 53 59.59	10.040	16 37 46.2	43.51	16 7.33	0.183
Saturday .	9	14 58 0.97	10.075	16 55 2.1	42.80	16 2.52	0.218
Sunday . .	10	15 2 3.19	10.110	17 12 0.8	42.08	15 56.86	0.253
Monday .	11	15 6 6.27	10.146	17 28 41.8	41.34	15 50.36	0.289
Tuesday .	12	15 10 10.21	10.182	17 45 4.9	40.58	15 43.00	0.325
Wednes'y	13	15 14 15.00	10.218	18 1 9.5	39.80	15 34.78	0.360
Thursday	14	15 18 20.66	10.254	18 16 55.3	39.01	15 25.71	0.396
Friday . . .	15	15 22 27.18	10.290	18 32 22.0	38.21	15 15.77	0.432
Saturday .	16	15 26 34.57	10.326	18 47 29.2	37.38	15 4.97	0.468
Sunday . .	17	15 30 42.81	10.361	19 2 16.3	36.54	14 53.32	0.503
Monday .	18	15 34 51.91	10.397	19 16 43.1	35.68	14 40.81	0.539
Tuesday .	19	15 39 1.85	10.432	19 30 49.1	34.81	14 27.46	0.574
Wednes'y	20	15 43 12.64	10.467	19 44 33.9	33.92	14 13.27	0.609
Thursday	21	15 47 24.27	10.502	19 57 57.2	33.01	13 58.24	0.643
Friday . . .	22	15 51 36.72	10.535	20 10 58.6	32.10	13 42.40	0.677
Saturday .	23	15 55 49.97	10.569	20 23 37.8	31.16	13 25.75	0.710
Sunday . .	24	16 0 4.01	10.601	20 35 54.3	30.21	13 8.31	0.743
Monday .	25	16 4 18.82	10.633	20 47 47.7	29.24	12 50.10	0.774
Tuesday .	26	16 8 34.38	10.664	20 59 17.9	28.26	12 31.15	0.805
Wednes'y	27	16 12 50.67	10.694	21 10 24.4	27.27	12 11.47	0.835
Thursday	28	16 17 7.67	10.722	21 21 6.8	26.26	11 51.09	0.863
Friday . . .	29	16 21 25.34	10.750	21 31 25.0	25.24	11 30.03	0.891
Saturday .	30	16 25 43.68	10.777	21 41 18.5	24.21	11 8.31	0.918

TABLE XXI.

NOVEMBER, 1878.—Page 2.

AT MEAN NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination.			Equation of Time, *to be added to Mean Time.*
		Apparent Right Ascension	*Apparent* Declination.	Semi-diameter.	
		h. m. s.	° ′ ″	′ ″	m. s.
Friday......	1	14 26 15.75	S. 14 29 37.5	16 9.7	16 17.92
Saturday....	2	14 30 11.42	14 48 43.1	16 9.9	16 18.81
Sunday	3	14 34 7.87	15 7 34.2	16 10.2	16 18.92
Monday	4	14 38 5.12	15 26 10.4	16 10.4	16 18.22
Tuesday	5	14 42 3.18	15 44 31.2	16 10.6	16 16.71
Wednesday	6	14 46 2.06	16 2 36.3	16 10.9	16 14.39
Thursday ...	7	14 50 1.76	16 20 25.3	16 11.1	16 11.25
Friday......	8	14 54 2.29	16 37 57.9	16 11.3	16 7.28
Saturday....	9	14 58 3.66	16 55 13.5	16 11.6	16 2.46
Sunday	10	15 2 5.88	17 12 11.9	16 11.8	15 56.80
Monday	11	15 6 8.95	17 28 52.7	16 12.0	15 50 28
Tuesday	12	15 10 12.88	17 45 15.5	16 12.3	15 42.91
Wednesday .	13	15 14 17.66	18 1 19.8	16 12.5	15 34.69
Thursday ...	14	15 18 23.30	18 17 5.4	16 12.7	15 25.60
Friday......	15	15 22 29.80	18 32 31.7	16 12.9	15 15.66
Saturday....	16	15 26 37.16	18 47 38.5	16 13.1	15 4 85
Sunday	17	15 30 45.38	19 2 25.3	16 13.3	14 53.19
Monday	18	15 34 54.45	19 16 51.8	16 13.5	14 40.68
Tuesday	19	15 39 4.36	19 30 57.5	16 13.7	14 27.32
Wednesday .	20	15 43 15.12	19 44 42.0	16 13.9	14 13.12
Thursday ...	21	15 47 26.71	19 58 4.9	16 14.1	13 58.09
Friday......	22	15 51 39.12	20 11 6.0	16 14.3	13 42.24
Saturday....	23	15 55 52.33	20 23 44.8	16 14.4	13 25.59
Sunday	24	16 0 6.33	20 36 0.9	16 14.6	13 8 15
Monday	25	16 4 21.10	20 47 54.0	16 14.8	12 49.94
Tuesday	26	16 8 36.61	20 59 23.8	16 15.0	12 30.98
Wednesday .	27	16 12 52.85	21 10 29.9	16 15.1	12 11.30
Thursday ...	28	16 17 9.79	21 21 12.0	16 15.3	11 50.92
Friday......	29	16 21 27.40	21 31 29.8	16 15.5	11 29.86
Saturday ...	30	16 25 45.68	21 41 23.0	16 15.6	11 8.14

TABLE XXI.

DECEMBER, 1878.—**Page 1.**

AT APPARENT NOON.

Day of the Week.	Day of the Month.	THE SUN'S RIGHT ASCENSION AND DECLINATION.				Equation of Time *to be subt. from* / *added to* *Apparent Time.*	Var. in 1 hour.
		Apparent Right Ascension	Var. in 1 hour.	*Apparent* Declination.	Var. in 1 hour.		
		h. m. s.	s.	° ′ ″	″	m. s.	s.
Sunday . .	1	16 30 2.66	10.804	S. 21 50 47.1	23.16	10 45.95	0.944
Monday .	2	16 34 22.27	10.829	21 59 50.4	22.11	10 22.96	0.970
Tuesday .	3	16 38 42.47	10 854	22 8 28.4	21.05	9 59.38	0.994
Wednes'y	4	16 43 3.25	10.878	22 16 40.7	19.97	9 35.23	1.018
Thursday	5	16 47 24.59	10.900	22 24 27.0	18.88	9 10.52	1.041
Friday . . .	6	16 51 46.46	10.922	22 31 47.0	17.79	8 45.27	1.063
Saturday .	7	16 56 8.84	10.943	22 38 40.7	16.68	8 19.52	1.083
Sunday . .	8	17 0 31.71	10.963	22 45 7.7	15.57	7 53.28	1.103
Monday .	9	17 4 55.04	10.981	22 51 8.0	14.45	7 26.58	1.122
Tuesday .	10	17 9 18.81	10.999	22 56 41.2	13.32	6 59.44	1.139
Wednes'y	11	17 13 42.99	11.015	23 1 47.3	12.18	6 31.90	1.155
Thursday	12	17 18 7.55	11.031	23 6 26.0	11.04	6 3.98	1.171
Friday . . .	13	17 22 32.46	11.045	23 10 37.2	9.89	5 35.70	1.185
Saturday .	14	17 26 57.71	11.058	23 14 20.8	8.74	5 7.09	1.198
Sunday . .	15	17 31 23.25	11.070	23 17 36.6	7.58	4 38.19	1.210
Monday .	16	17 35 49.06	11.080	23 20 24 4	6.41	4 9 02	1 220
Tuesday .	17	17 40 15.11	11.090	23 22 44.1	5.24	3 39.61	1.230
Wednes'y	18	17 44 41.36	11.098	23 24 35.7	4.06	3 9.99	1.238
Thursday	19	17 49 7.78	11.104	23 25 59.1	2.88	2 40.21	1.244
Friday . . .	20	17 53 34.35	11.109	23 26 54.1	1.70	2 10.29	1.249
Saturday .	21	17 58 1.01	11.112	23 27 20.8	0.52	1 40.26	1.252
Sunday . .	22	18 2 27.74	11.114	23 27 19.2	0.66	1 10.18	1.254
Monday .	23	18 6 54.49	11.114	23 26 49.2	1.84	0 40.07	1.254
Tuesday .	24	18 11 21.21	11.112	23 25 50.9	3.02	0 9.99	1.252
Wednes'y	25	18 15 47.87	11.109	23 24 24.3	4.20	0 20.03	1.249
Thursday	26	18 20 14.43	11.104	23 22 29.4	5.37	0 49.95	1.244
Friday . . .	27	18 24 40.84	11.097	23 20 6.3	6.55	1 19.73	1.237
Saturday .	28	18 29 7.08	11.089	23 17 15.1	7.72	1 49.32	1.229
Sunday . .	29	18 33 33.11	11.079	23 13 55.8	8.89	2 18.71	1.219
Monday .	30	18 37 58.88	11.068	23 10 8.6	10.05	2 47.85	1.208
Tuesday .	31	18 42 24.38	11.056	23 5 53.6	11.20	3 16.71	1.196

TABLE XXI.

DECEMBER, 1878.—**Page 2.**

AT MEAN NOON.

Day of the Week.	Day of the Month.	The Sun's Right Ascension and Declination.			Equation of Time, *to be added to* / *subt. from Mean Time.*
		Apparent Right Ascension	*Apparent* Declination.	Semi-diameter.	
		h. m. s.	° ′ ″	′ ″	m. s.
Sunday	1	16 30 4.60	S.21 50 51.2	16 15.8	10 45.78
Monday	2	16 34 24.14	21 59 54.2	16 15.9	10 22.80
Tuesday	3	16 38 44.28	22 8 31.9	16 16.1	9 59.22
Wednesday .	4	16 43 4.99	22 16 43.9	16 16.3	9 35.07
Thursday ...	5	16 47 26.25	22 24 29.8	16 16.4	9 10.36
Friday	6	16 51 48.05	22 31 49.6	16 16.5	8 45.12
Saturday	7	16 56 10.36	22 38 43.0	16 16.6	8 19.37
Sunday	8	17 0 36.15	22 45 9.8	16 16.8	7 53.13
Monday	9	17 4 56.41	22 51 9.8	16 16.9	7 26.44
Tuesday	10	17 9 20.09	22 56 42.8	16 17.0	6 59.31
Wednesday .	11	17 13 44.19	23 1 48.7	16 17.1	6 31.78
Thursday ...	12	17 18 8.66	23 6 27.2	16 17.2	6 3.86
Friday	13	17 22 33.49	23 10 38.2	16 17.3	5 35.59
Saturday	14	17 26 58.65	23 14 21.5	16 17.4	5 6.99
Sunday	15	17 31 24.10	23 17 37.1	16 17.5	4 38.09
Monday	16	17 35 49.82	23 20 24.8	16 17.5	4 8.93
Tuesday	17	17 40 15.78	23 22 44.4	16 17.6	3 39.53
Wednesday .	18	17 44 41.94	23 24 35.9	16 17.7	3 9.93
Thursday ...	19	17 49 8.28	23 25 59.2	16 17.7	2 40.15
Friday	20	17 53 34.75	23 26 54.2	16 17.8	2 10.24
Saturday	21	17 58 1.32	23 27 20.9	16 17.9	1 40.23
Sunday	22	18 2 27.95	23 27 19.2	16 17.9	1 10.15
Monday	23	18 6 54.61	23 26 49.2	16 18.0	0 40.06
Tuesday	24	18 11 21.24	23 25 50.9	16 18.0	0 9.98
Wednesday.	25	18 15 47.81	23 24 24.3	16 18.1	0 20.03
Thursday ...	26	18 20 14.28	23 22 29.5	16 18.1	0 49.93
Friday	27	18 24 40.60	23 20 6.5	16 18.1	1 19.70
Saturday	28	18 29 6.75	23 17 15.3	16 18.2	1 49.29
Sunday	29	18 33 32.68	23 13 56.2	16 18.2	2 18.66
Monday	30	18 37 58.37	23 10 9.1	16 18.2	2 47.79
Tuesday	31	18 42 23.78	23 5 54.2	16 18.2	3 16.64

TABLE XXII.

LATITUDES AND LONGITUDES

Of the Principal Ports, Capes, and Lights in the World.

East Coast of United States of America.

	LAT.	LONG.		LAT.	LONG.
Quoddy-head Light..	44° 49′ N	66° 58′ W	Philadelphia (St. H.)	39° 57′ N	75° 09′ W
Mt. Desert-rock “ .	43 58	68 08	Cape Charles........	37 07	75 58
Martinicus Island Lt.	43 47	68 51	Cape Henry Light...	36 55	76 00
Portland Light......	43 37	70 12	Richmond	37 32	77 26
Cape Ann (Thatcher's Island) Light.. ...	42 38	70 34	Washington City....	38 53	77 00
			Baltimore...........	39 18	76 37
Salem (City Hall)...	42 31	70 54	Cape Hatteras	35 15	75 31
Boston L. H........	42 20	70 53	Cape Lookout Light.	34 37	76 31
Boston (State House)	42 21	71 04	Cape Fear “	33 52	78 00
Cape Cod Light.....	42 02	70 03	Georgetown “	33 13	79 11
Nantucket harbor Lt.	41 16	70 04	Charleston “	32 42	79 52
New Bedford L. H..	41 35	70 54	Tybee “	32 01	80 51
Newport Spire......	41 29	71 18	Savannah	32 05	81 05
Block Island Light..	41 13	71 34	Cape Carnaveral	28 28	80 34
New London L. H..	41 19	72 05	Cape Florida Light..	25 40	80 09
Montauk Point L. H.	41 04	71 51	Key West “	24 33	81 48
New York (City Hall)	40 43	74 00	Pensacola “	30 21	87 17
Sandy Hook Light ..	40 28	74 00	Mobile Point “	30 14	88 00
Neversink Light....	40 24	73 59	New Orleans........	29 57	90 00
Cape May Light	38 56	74 57	Galveston (entrance).	29 20	94 45
Cape Henlopen L. H.	38 47	75 05			

Islands in the West Indies.

Trinidad (Pt. Galiote)	10 10 N	61 00 W	Port au Prince......	18 33 N	72 16 W
Tobago (N.E. Point)	11 20	60 27	Cape Hayti City	19 46	72 11
Grenada (S. W. Point)	12 00	61 49	Kingston	17 58	76 46
Barbadoes (S. Point)	13 03	59 37	St. Jago de Cuba Lt.	19 58	75 52
Martinico “	14 27	60 55	Manzanillo	20 20	77 11
Dominica (N. Point).	15 38	61 26	Havana (the Moro)..	23 09	82 22
Guadeloupe (NE. Pt.)	16 30	61 29	Matanzas...........	23 03	81 40
Porto Rico (St. A. Bt.)	18 29	66 07	Hole-in-the-wall Lt..	25 51	77 11
St. Domingo Light..	18 28	69 52	Georgetown	32 22	64 38

East Coast of America.

Vera Cruz..........	19 12 N	96 09 W	Para	1 28 S	48 29 W
Balize...............	17 29	88 12	Pernambuco	8 04	34 52
Campeche	19 49	90 33	Cape St. Roque	5 28	35 17
Porto Bello.........	9 34	79 40	Cape St. Augustin ..	8 21	34 57
Cartagena	10 26	75 38	Bahia, St. Antonio Lt.	13 01	38 32
Maracaybo	10 39	71 45	Cape St. Thomas....	22 03	41 00
Porto Cabello.......	10 28	68 07	Cape Frio	23 01	41 59
Caraccas............	10 30	67 01	Rio Janeiro.........	22 56	43 09
Georgetown Light...	6 49	58 11	Monte Video........	34 53	56 13
Paramaribo.........	5 48	55 00	Buenos Ayres.......	34 36	58 22
Cayenne	4 56	52 13	Cape Horn..........	55 59	67 16
River Amazon	1 10	50 00			

West Coast of America.

Valparaiso	33 02 S	71 41 W	Acapulco...........	16 55 N	99 48 W
Lima	12 03	77 06	San Francisco	37 48	122 26
Callao..............	12 04	77 13	Nootka.............	49 36	126 35
Guayaquil..........	2 13	79 53	Icy Cape	70 29	161 42
Panama	8 57 N	79 31			

East Coast of North America.

Cape Sable	43 24 N	65 36 W	Cape Race..........	46 39 N	53 05 W
Halifax.............	44 39	63 55	St. Johns...........	47 34	52 43
Cape Canso.........	45 19	60 55	Quebec.............	46 49	71 16
Cape Breton	45 57	59 48	Cape Farewell	59 49	43 54
Gut of Canso.......	45 42	61 29			

TABLE XXII.

LATITUDES AND LONGITUDES

Of the Principal Ports, Capes, and Lights in the World.

England, Scotland, and Ireland.

	LAT. ° ′	LONG. ° ′		LAT. ° ′	LONG. ° ′
Lizard Point	49 58 N	5 12 W	Glasgow	55 52 N	4 16 W
Plymouth	50 22	4 10	Carlisle	54 54	2 56
Portsmouth	50 47	1 06	Liverpool	53 25	3 00
Dover	51 08	1 19 E	Bristol	51 27	2 35
London	51 31	0 06 W	Cape Clear Light	51 26	9 29
Yarmouth	52 37	1 44 E	Limerick	52 40	8 39
Hull	53 45	0 20 W	Londonderry	55 00	7 19
Berwick Light	55 46	1 59	Belfast	54 35	5 57
Dunbar	56 00	2 29	Dublin	53 23	6 20
Edinburgh	55 57	3 12	Cork	51 48	8 15
Aberdeen	57 09	2 08	Baltimore	51 29	9 22
Duncansby Head	58 40	3 08			

From Gibraltar to the Scaw.

	LAT.	LONG.		LAT.	LONG.
Gibraltar	36 07 N	5 21 W	Ushant Light	48 29 N	5 03 W
Cadiz Light	36 32	6 18	Cherbourg	49 38	1 37
Seville	36 59	5 58	Paris	48 50	2 20 E
Cape St. Vincent Lt.	37 03	9 00	Havre de Grace	49 29	0 06
Lisbon	38 42	9 09	Boulogne	50 44	1 37
Oporto Light	41 09	8 37	Calais	50 58	1 51
Corunna “	43 22	8 24	Dunkirk	51 03	2 22
Ferrol	43 30	8 13	Ostend	51 14	2 55
Santander Light	43 30	3 47	Antwerp	51 13	4 24
Bilbao	43 15	2 54	Flushing	51 27	3 35
Bayonne	43 29	1 29	Rotterdam	51 54	4 29
Bordeaux	44 50	0 34	Amsterdam	52 22	4 53
Cordouan Light	45 35	1 10	Embden	53 22	7 12
Rochefort	45 56	0 58	Bremen	53 05	8 49
Rochelle Light	46 09	1 09	Hamburgh	53 33	9 58
Nantes	47 13	1 33	Scaw Light	57 43	10 37
Brest	48 23	4 29			

Cattegat and Sound, the Baltic, and the Gulfs of Finland and Bothnia.

	LAT.	LONG.		LAT.	LONG.
The Naze Light	57 38 N	7 02 E	Dantzig	54 22 N	18 41 E
Christiana	59 55	10 43	Konigsberg	54 43	20 30
Gothenburgh	57 42	11 55	Riga	56 57	24 06
Copenhagen	55 41	12 34	Bergen (Isl'd Rugen)	54 25	13 28
Elsineur	56 02	12 37	Revel	59 26	24 45
Carlscrona	56 10	15 36	Cronstadt	59 59	29 47
Stockholm	59 21	18 04	Petersburg	59 56	30 19
Lubeck	53 52	10 42	Tornea	65 51	24 14

The Mediterranean.

	LAT.	LONG.		LAT.	LONG.
Gibraltar	36 07 N	5 21 W	Venice	45 26 N	12 21 E
Malaga	36 43	4 26	Trieste	45 39	13 46
Carthagena	37 36	1 01	Ragusa	42 38	18 07
Alicante	38 20	0 26	Corinth	37 54	22 52
Valencia	39 28	0 24	Athens	37 58	23 44
Terragona	41 09	1 18 E	Salonica	40 39	22 57
Barcelona	41 23	2 11	Constantinople	41 01	28 59
Marseilles	43 18	5 22	Smyrna	38 26	27 07
Toulon	43 07	5 56	Aleppo	36 11	37 10
Genoa	44 24	8 53	Cairo	30 03	31 18
Florence	43 46	11 16	Alexandria	31 12	29 53
Leghorn	43 32	10 18	Tripoli	32 54	13 11
Rome	41 54	12 27	Tunis	36 47	10 06
Naples	40 50	14 16	Algiers	36 47	3 04
Ancona Light	43 38	13 30	Tangier	35 47	5 50 W

TABLE XXII.

LATITUDES AND LONGITUDES

Of the Principal Ports, Capes, and Lights in the World.

West Coast of Africa.

	LAT.	LONG.		LAT.	LONG.
Cape Spartel	35° 48′ N	5° 54′ W	Sierra Leone Cape	8° 30′ N	13° 18′ W
Mogador	31 31	9 46	Capetown	33 56 S	18 29 E
Senegal	16 01	16 32	Cape of Good Hope	34 22	18 30
Cape Verde	14 44	17 32	Cape Lagullas	34 50	20 01

Islands in the Atlantic Ocean.

	LAT.	LONG.		LAT.	LONG.
Fayal, S.E. point	38 30 N	28 42 W	Porto Praya	14 54 N	23 30 W
Funchal	32 38	16 55	Ascension	7 56 S	14 25
Santa Cruz(Teneriffe)	28 28	16 16	St. Helena (Jamestown)	15 55	5 45
" (St. Anthony)	17 02	25 15			

From Cape of Good Hope to Kamtskatka.

	LAT.	LONG.		LAT.	LONG.
Cape Lagullas	34 50 S	20 01 E	Masulipatam	16 09 N	81 08 E
Mozambique	15 03	40 48	Ballasore	21 30	87 10
Suez	29 59 N	32 34	Calcutta	22 34	88 20
Mocha	13 20	43 12	Pegu	18 00	96 52
Bassora	30 30	48 00	Point Romania	1 23	104 16
Surat	21 11	72 47	Siam	14 55	100 00
Bombay	18 54	72 52	Hong Kong	22 15	114 22
Goa	15 28	73 52	Canton	23 07	113 14
Mangalore	12 51	74 49	Shanghai	31 12	121 28
Cape Comorin	8 05	77 30	Nankin	32 02	118 49
Ceylon (Columbo Lt.)	6 56	79 49	Pekin	39 54	116 29
Pondicherry	11 56	79 50	St. Peter and St. Paul	53 00	158 44
Madras	13 04	80 16	North Cape	68 56	179 47 W

Islands in the Indian and Pacific Oceans.

	LAT.	LONG.		LAT.	LONG.
Madagascar—			Niphon (Yeddo)	35 40 N	140 00 E
Cape St. Mary	25 39 S	45 07 E	Jesso (Matzumay)	41 32	140 04
Cape Amber	11 58	49 19	Australia—		
Mauritius (Pt. Louis)	20 10	57 30	Cape York	10 44 S	142 33
Sumatra (Bencoolen)	3 48	102 19	N.W. Cape	21 50	114 04
Java (Batavia)	6 08	106 50	Sydney	33 52	151 14
Banca (South Point)	3 08	106 28	Botany Bay	34 02	151 13
Singapore (East Pt.)	1 22 N	104 00	Melbourne	37 49	144 58
Borneo (Road)	5 00	115 00	Sandwich Islands—		
Celebes (Macassar)	5 09 S	119 23	Owhyhee (N. Pt.)	20 23 N	155 54 W
Amboyna (Ft. Vict.)	3 41	128 10	" (E. Pt.)	19 34	154 54
Formosa (S. Cape)	21 56 N	120 56	Honolulu	21 19	157 52

Coast of California.

	LAT.	LONG.
St. Diego, Point Loma	32° 38′.8 N	117° 14′.7 W
St. Catalina Island	33 28	118 38
Santa Cruz Island, W. end	34 10	119 47
Point Conception	34 31	120 30
Mount Buchon	35 18	120 50
Point Pinos	36 38.5	121 55
Monterey Fort	36 36.4	121 53
Farallones Rocks peak	37 42	122 59
San Francisco Fort, S. side entrance	37 48.5	122 28.5
Mt. Bolbones, 3765 ft. 10 leag. inland	37 52.9	121 54.5
Cape Mendocino	40 29	124 32
Cape Perpetua	44 12	124 17
Pt. Adam entrance, Columbo River	46 12	124 1
Cape Disappointment	16 16	124 5
Astoria City	46 10	123 49
Pacific City	46 20	124 3
Gray's Harbor, N. Head	47 0	124 7
Cape Flattery S. side ent. of Straits of Juan de Fuca	48 9	124 46

TESTIMONIALS.

From a long list of subscribers we select the following names as evidencing that our "GUIDE" has won the patronage of the best nautical men:

W. B. Seabury, Commanding Steamship *Alaska*, P. M. S. S. Co.
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James E. Hunter, Third Officer “ “ “
D. E. Friele, Commanding Steamship *China*, P. M. S. S. Co.
Thos. Golding, First Officer “ “ “
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H. C. Dearborn, Commanding Steamship *City of Sydney.*
F. H. Johnson, First Officer “ “
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A. H. Panzes, Third Officer “ “
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Thos. P. Deering, Second Officer “ “ “
W. Ward, Third Officer “ “ “
G. G. Berry, Commanding Steamship *China*, P. M. S. S. Co.
J. T. Malcohm, First Officer Steamship *Los Angeles*, P. M. S. S. Co.

This work, the first of its kind published within the last half-century, seems, upon even cursory glance, admirably calculated to effect the professed object, viz., to enable the navigator to find at any time, quickly and accurately, his position at sea. The text-matter is exceedingly clear and concise. The rules and instructions, throughout, though based on theory, are altogether practical, and will in no wise repel the non-scientific seafarer from attaining (as far as can be done from a book), a trustworthy knowledge of what he most needs. Only a man who knows by experience the sailor's wants, could have written this book, which, from the arrangement of its matter as well as from its numerous original problems—all carefully worked out—and valuable practical suggestions, will we think, make it prized wherever it finds its way. We certainly think that all navigators, no matter what their attainments, but especially those who have yet to advance in their profession, will find it advantageous to make themselves acquainted with the contents of this work. Its typographical execution is admirable, and reflects great credit on the publishers.—*Alta California*, May 20, 1878.

This book, prepared by Captain E. McNevin, appears, after a careful survey of its pages, to be all that it claims on its title page. It gives the rules for solving all necessary nautical problems in the simplest and most practical manner, and enables the seaman to find, without other aid than that of an ordinary education, his position at sea. It attracts from the first, beginning with the matter that a sailor should first know, viz., the compass and a table of the angles which its points and quarter-points make with the meridian. The book is interspersed with practical and original suggestions that cannot fail to be appreciated by seamen. The method of finding simultaneously, latitude and longitude by double altitudes has not, we believe, heretofore been published in any American work. The same good judgment is observable in the arrangement of the the tables as of the text. The first gives the logarithmic lines, tangents, etc., for the points and quarter-points of the compass, and the second the logarithms of the natural numbers. The typographical appearance of the tables is excellent, the columns being so well spaced and the figures so distinct that they can be used with facility and without danger of error—an important point for both student and navigator. A great deal has been written about the deviation of the compass; but we venture to say that the few paragraphs of this book on the subject will be all that the student need ever seek to know, either as to its theory or use. We predict for this book, which must have cost its author much time and thought, a large patronage.—*Morning Call*, June 7, 1878.

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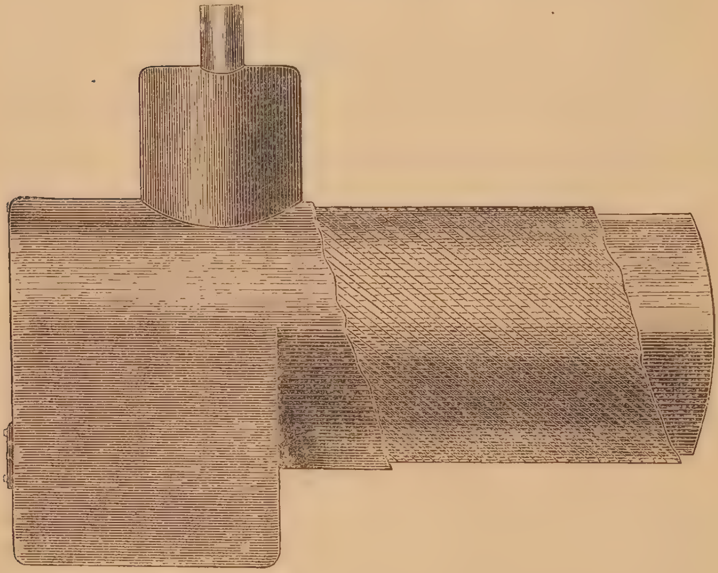

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Steam Tug Lookout,	“
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Price & Lee's Wool Bleaching Mill	“
State Harbor Dredgers,	“
Tug Anasha,	“
Fire Commissioners' Tug Gov. Irwin,	“
Sacramento Coffee and Spice Mills,	“
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Steamer Washington,	“
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Occidental Hotel,	“
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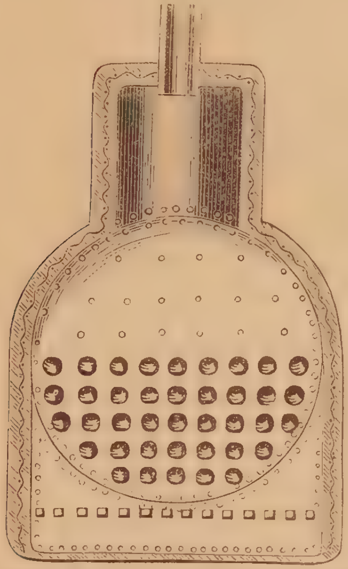
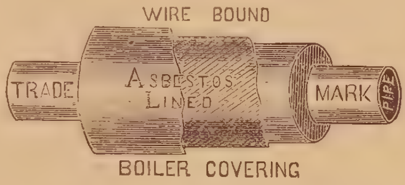
Consolidated Virginia Mine,	“
C & C. Shaft,	“
Stockton Steamer Centennial.	
“ “ City of Stockton.	
“ “ Alice Garratt.	
Sacramento Sawing & Planing Mills,	Sacramento
Sacramento Flouring Mills,	“
Pioneer Box Factory	“
Phœnix Flouring Mills,	“
H. S. Crocker & Co.	“
R. E. Barnes & Co.	“
Brooklyn Jute Works,	Brooklyn





That our customers may understand our true position in the suits recently brought against us by the U. S. Salamander Felting Co., for alleged infringement of their patents, we beg to say that the charge is absurd for the simple reason that our interest lay in carefully avoiding the use of any of their material, our own patented one being much superior. The move against us is merely an advertising dodge and a futile attempt to injure our business by deceiving the public. They had the effrontery of notifying our customers not to pay us for work done, just as if we were not responsible to our patrons for all our acts.

We hope our friends will stand by us, and we assure them that the Salamander Felting Company will be glad to get off by paying the costs of suit. Our opinion is that they never intend to allow the case to come to trial, knowing full well that we have never used their material. Our success in business has driven them to their wits' end and their only resource is to commence suit to frighten away from us the patronage of the timid and ignorant.

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San Francisco, May 8th, 1878.

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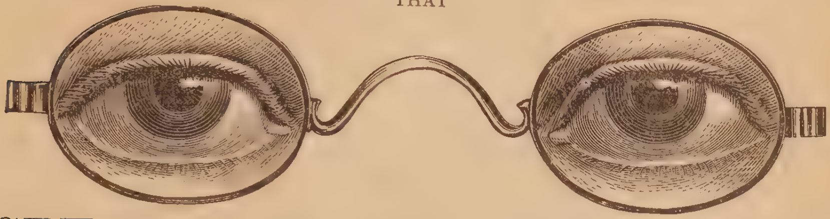

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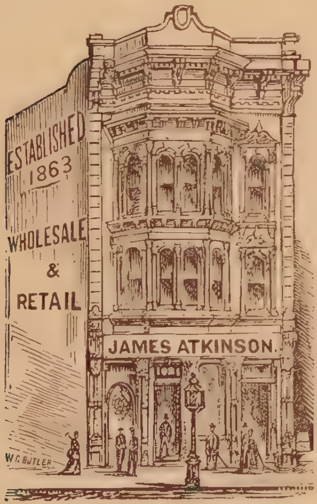

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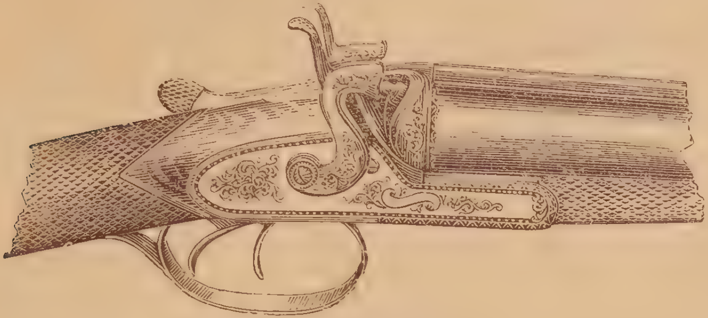

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